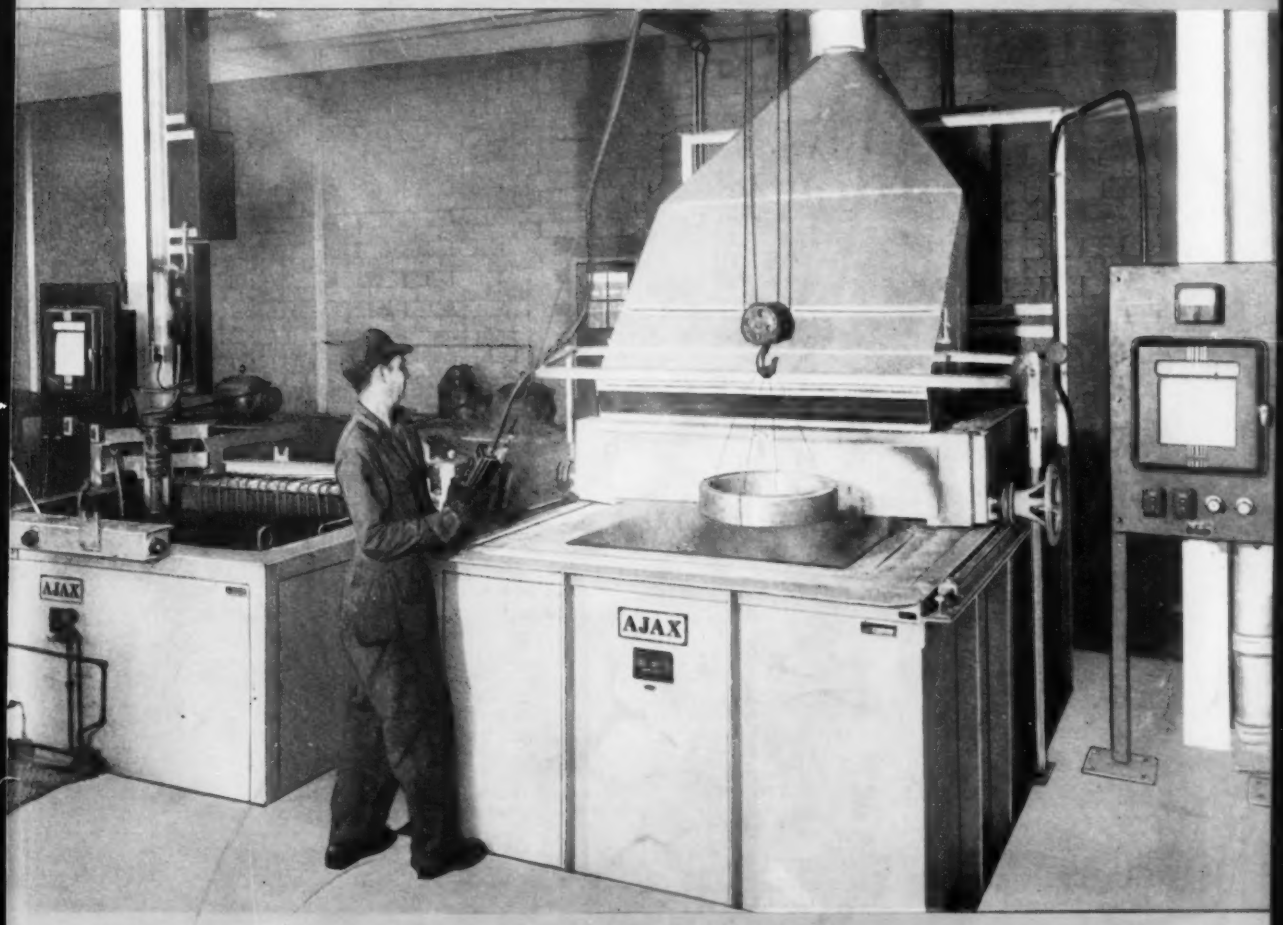
Aug 26 '54 117

July-August 1954

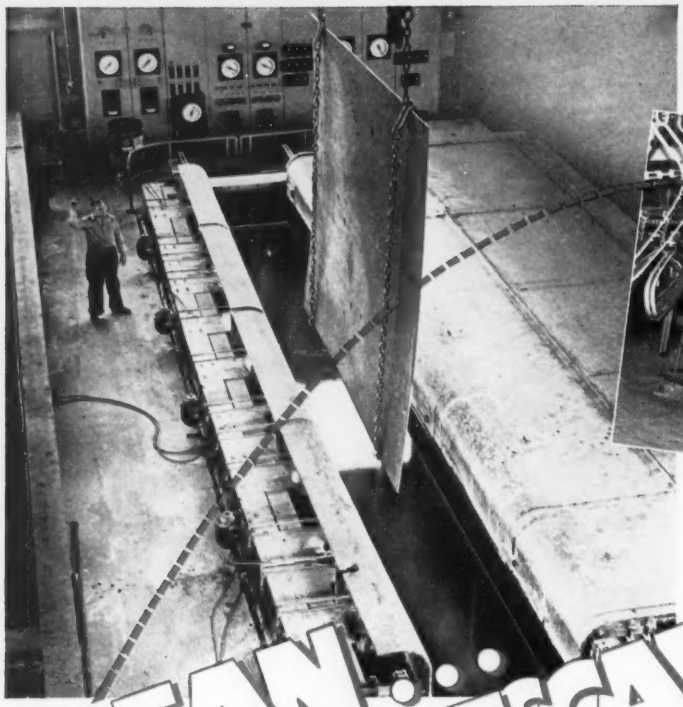
METAL TREATING

MTI MASTER CRAFTSMEN
METAL TREATING INSTITUTE

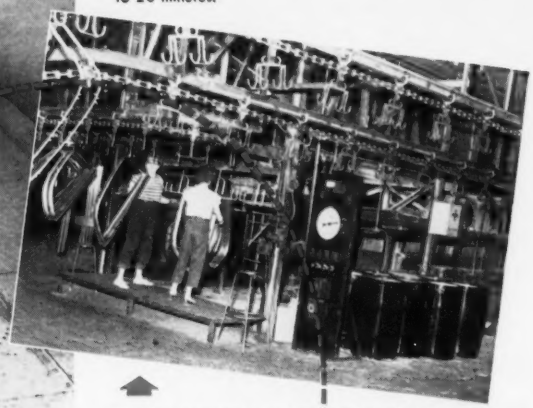
Martempering bearing races (18" in diameter) illustrates one of the many uses of salt baths described in this issue. See page 2.



THE Only MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY



Stainless, carbon, alloy and high-speed tool steels and non-ferrous alloys descaled in from 15 seconds to 20 minutes.



Drawing compounds and paint stripped from metal stampings in 50 seconds.

CLEAN... DESCALE... DESAND

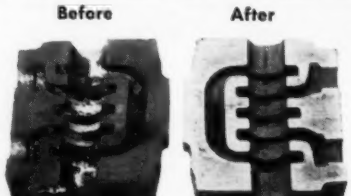
...faster, better at appreciably less cost

From removing metallic oxide scale from huge plates, coils or bars to desanding molds or cleaning residual materials from stampings, the Ajax Electric Salt Bath Furnace paves the way to appreciable savings in labor, floor space and time. What's more, the work is done far more efficiently than is possible with sand-blasting, acid pickling, electrolytic anodic cleaning or other methods.

The Ajax Salt Bath Furnace is adaptable to many metal and alloy types. Different metals and different metal shapes can be descaled simultaneously. The bath acts uniformly on all parts of the work including blind holes. The process reacts only on scale, sand or residual materials. The base metal is not affected and there is no hydrogen embrittlement. First cost of the equipment is low and so is upkeep. Pot and electrode life is measured in years and the bath can be regenerated indefinitely by the addition of low cost chemicals. Where desired, the entire process can be mechanized for highly efficient mass production.

Write today, giving details of your finishing problem. Let Ajax engineers prove these claims—at not the slightest obligation. Reprinted technical articles on cleaning, descaling and desanding are available on request.

Grease, drawing compounds, residual rubber, carbon black, plastics, paint and enamel removed in minutes with less labor.



Residual sand removed from these pump castings by 3-minute bath immersion at 700° F.

AJAX ELECTRIC COMPANY

WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY

940 Frankford Ave. Philadelphia 23, Pa.

Associate companies: Ajax Electric Corp.; Ajax Engineering Corp.; Ajax Electrothermic Corp.

AJAX ELECTRIC SALT BATH FURNACES

MASTER CRAFTSMEN
METAL TREATING INSTITUTE

Vol. V No. 4
JULY-AUGUST 1954

★ ★ ★

Editor, C. E. HERINGTON

Asst. Editor, JOHN J. CODELLA

Advt. & Prod. Mgr., B. A. FLANAGAN

Chairman, Publication Committee
H. C. KNERR, Metlab Company, Phila., Pa.

Business Mgr., JOHN J. CODELLA

SALES REPRESENTATIVES

W. W. ANDREWS, 3906 Livingston Road, Cleveland 20, O., WY 1-7144

W. F. GREEN, 439 S. Western Ave., Los Angeles 5, Calif., DU 7-8135

N. K. PETTIGREW, 73 Columbia Ave. Gaspee Plateau 5, R. I., HO 1-2725

R. F. PICKRELL, 314 Stephenson Bldg., Detroit 2, Mich., TR 1-0790

DICK WESTON, 6 East 39th St., New York 16, N.Y., MU 5-9450

★ ★ ★

Officers of
The Metal Treating Institute
1954

President
C. M. Cook
Cook Heat Treating Co.
Houston, Texas

Vice-President
C. R. Weir
Commonwealth Industries, Inc.
Detroit, Michigan

Treasurer
Lloyd G. Field
Greenman Steel Treating Co.
Worcester, Massachusetts

Executive Secretary
C. E. Herington
271 North Avenue
New Rochelle, New York

Official Journal of the Metal Treating Institute

National Trade Association of Commercial Heat Treaters

The presentation of editorial material in "Metal Treating" should not be interpreted as either an endorsement or recommendation by the Metal Treating Institute of the statements set forth.
Published by the Metal Treating Institute, 271 North Avenue, New Rochelle, N. Y.
Copyright 1954 by the Metal Treating Institute.

METAL TREATING

EDITORIAL

KNOW YOUR HEAT TREATING COSTS

A proper knowledge of the costs of doing business, any business, is the fundamental basis upon which success (profitable operation) is built. All other factors in a business operation can be "right"—plant, equipment, production, sales—but if COSTS are not known, evaluated and properly projected into selling price—failure looms inevitably.

These facts, of course, are perhaps particularly true of heat treating operations whether as a manufacturing process or as a commercial service to industry. Aware of this, a Cost Accounting Committee was established by the Metal Treating Institute. The work of this group was so thorough and so applicable to *all* heat treating activities that the full reports and recommendations of the Committee are being published in full in this and the next issue of METAL TREATING. (Pages 4 to 8.)

A proper study and application of the facts established in these papers will, we are sure, help you "know your heat treating costs" whether your operations are small or large and regardless of whether your facilities are part and parcel of a manufacturing operation or are devoted to serving industry on a commercial basis.

C. E. Herington

CONTENTS

F E A T U R E S

2 Mechanization and APPLICATION OF SALT BATH FURNACES by Leon B. Rosseau
4 Cost Accounting for HEAT TREATING—Introduction by K. U. Jenks
5 DETERMINATION OF EXPENSES by Frederick C. Rimmele
8 ALLOCATION OF EXPENSES by Conrad H. Knerr
10 A Work Horse for Industry— THE WALKING BEAM FURNACE by W. A. Darrah
12 Steel Supplier Has MODERN PLANT FOR CUSTOMER SERVICE by Arthur Q. Smith

D E P A R T M E N T S

14 NEWS TO HEAT TREATERS
24 INSTITUTE NEWS
32 HEAT TREATING ABSTRACTS
40 LETTERS TO THE EDITOR
41 WHAT'S YOUR PROBLEM?
42 EQUIPMENT AND MATERIALS DIRECTORY
43 MANUFACTURERS' LITERATURE

Mechanization and
APPLICATION OF SALT BATH FURNACES

By **LEON B. ROSSEAU**

Vice President, Ajax Electric Company
Philadelphia, Pa.

In an integrated heat treating unit, many auxiliary devices are required such as quench tanks, wash tanks, dryers, conveyors, etc. Salt bath furnaces are eminently adaptable to mechanization but the apparatus used, however, has to be specifically designed for this purpose. Many different types are in use today. Generally speaking, they have common features—all moving components are external to the furnace, operate at ambient temperatures and are made of steel. Only the hangers, or fixtures, actually supporting the work, need be immersed in the salt. These, of course, have to be made of suitable heat resisting alloys.

The most common type of mechanism in use today is called the "Jack Rabbit" mechanism. This name comes from the fact that work is progressed horizontally through the furnace at a slow rate of speed while the transfers from one device to the other occur at much greater speed. The work actually jumps from one device to the other. Fig. 1 illustrates a conventional Jack Rabbit mechanism. Note that the work enters and leaves all devices vertically thus permitting shorter and more efficient furnaces, that any reasonable number of steps can be used and that a conveyor for returning the fixtures and carriers to the starting point is used. This type of mechanism permits any combination of time cycles desired in a straight line arrangement and uses comparatively little floor space although appreciable height is required.

A modification of this design is shown in Fig. 2 which is called the "Push-Pull" mechanism. In combination with the Jack Rabbit type, it provides

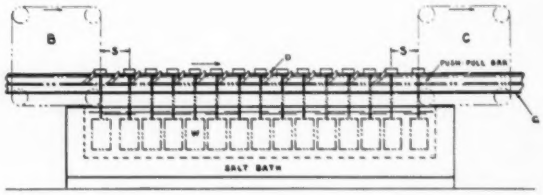


Fig. 2—Dogs on a reciprocating bar move work fixtures through the furnace in this "Push-Pull" mechanism. Closer spacing between work toward center of furnace provides greater efficiency.

for a more efficient furnace design due to its ability of leaving adequate clearances at the load and unload ends while eliminating this clearance in the main central portion of the furnace. A reduction in furnace length of as much as 25% for a given production is possible with this patented construction.

Where no quick quenching is required and where the time cycles in the different devices can be identical, the rotary positioner, or "merry-go-round," type of mechanism illustrated by Fig. 3 will be used. It generally requires a square space but much less height.

All of the above types perform all handling motions. Only loading and unloading of fixtures is required. In some cases, only partial mechanization is desired, for cycle controlling purposes. The over-

Fig. 1—Loading end of a "Jack Rabbit" mechanism handling compressor parts for liquid carburizing.

head screw conveyor illustrated by Fig. 4 can be used in such instances to obtain various times at temperature in the bath.

If the operating temperature of the furnace is low enough to permit it, the standard monorail shop type conveyor can also be used. However, it causes considerable increase in furnace length and,

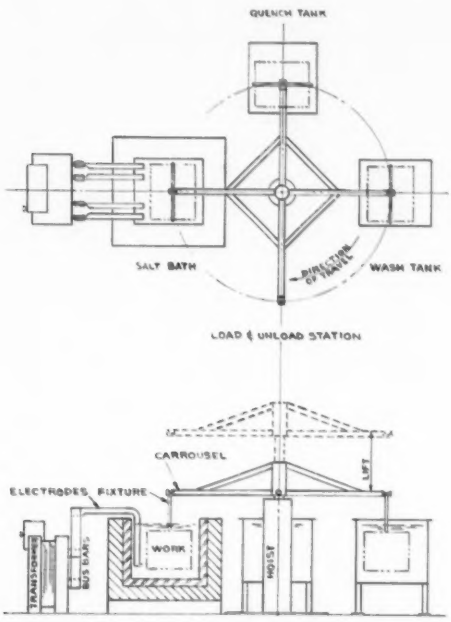


Fig. 3—"Merry-Go-Round" moves work in uniform cycles from one station to the next.

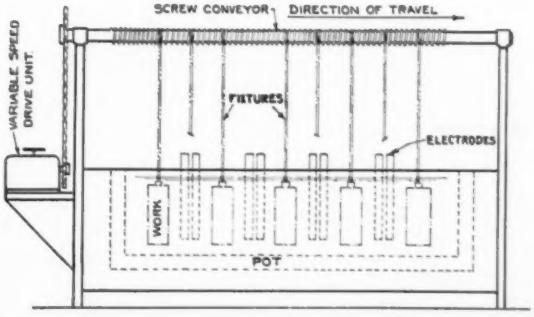


Fig. 4—Simplest of the mechanisms, this overhead screw conveyor provides cyclic control while work is in the furnace but does not affect handling.

therefore, greater losses because of the space wasted at the load and unload ends. These can be straight line or closed loop types as desired. Generally speaking, furnace temperature is limited to 1100° F. or slightly higher for this construction.

Many other special arrangements have been built for special purposes utilizing pneumatic and hydraulic cylinders as well as other conventional devices.

APPLICATIONS

With this brief review of the available equipment, let us now describe the principal applications to be seen in industry today.

Neutral Hardening

The term "neutral hardening" covers the hardening of work without affecting its surface, that is, without oxidizing or scaling it, and without the addition or subtraction of carbon from the steel. The salt is neutral to the steel and serves only as a heating medium. The salts used are generally mixtures of chlorides. Simple rectifying means are sometimes, but not always, used. The work is heated in one-fourth of the time required in radiantly heated furnaces and very high production rates are secured from compact equipment.

Neutral hardening corresponds to controlled atmosphere heating, and is used for an infinite variety of applications involving carbon steel, alloy steel, die steel, stainless steel, cast iron, etc. The absence of atmosphere generators, the high capacity of the equipment and the inherent control of distortion, in combination, are responsible for the hundreds of installations now in service. Fig. 5 illustrates the neutral hardening of automotive spline shafts in a salt bath equipped with a screw conveyor for cyclic control.

High Speed Steel Tool Hardening

The hardening of high speed steel tools is the most exacting operation in industry today. Even though it is necessary to heat the steel right up to the point of incipient fusion, 2200°-2400° F., a bright clean surface without any surface imperfections must be retained. The value of a single day's production may equal the total investment represented by a battery of furnaces. Therefore, superior

(Continued on page 26)

Fig. 5—Automotive spline shafts are neutral hardened in this screw conveyor equipped furnace.

Cost Accounting For
HEAT TREATING

* DETERMINATION OF EXPENSES
* ALLOCATION OF EXPENSES
* DETERMINATION OF UNIT COSTS
* APPLICATION OF UNIT COSTS

A series of four papers prepared by the Cost Accounting Committee of the Metal Treating Institute to provide a basic Cost Accounting System for heat treating operations.

MEMBERS, COST ACCOUNTING COMMITTEE
METAL TREATING INSTITUTE, 1953-4

K. U. Jenks, Chairman
Lindberg Steel Treating Company
Chicago, Illinois

F. C. Rimmele
Benedict-Miller, Inc.
Lyndhurst, N.J.

Conrad Knerr
Metlab Company
Philadelphia, Pa.

John Paterson
Commercial Steel Treating Company
Detroit, Mich.

C. H. Muehlemeyer
O. T. Muehlemeyer Heat Treating Co.
Rockford, Ill.

INTRODUCTION

By **K. U. JENKS, CHAIRMAN**

This Committee met in Cleveland during the last three days of February, 1954. Our objectives at that time were defined as follows:

(1) Discuss and consider various cost methods being used by, or applicable to, our industry.

(2) Determine what cost factors, methods and procedures are common to, or applicable to, all or most member plants.

(3) Consider and try to determine, if possible, the scope and/or limitations of a cost accounting program for the MTI.

(4) Prepare a rough draft of a basic cost accounting system to be presented at the MTI Spring Meeting.

We not only had 100% attendance at this meeting, but there was full participation in the discussions by each member. I am certain no committee chairman has ever received finer cooperation.

We considered the subject of Cost Accounting from many angles, including:

(1) Various types of cost.

(2) Relationship of each type of cost to productive operations.

(3) Appropriate methods of allocating the various types of cost to productive departments and/or equipment.

(4) Amount of work involved in determination of accurate costs.

(5) Relative value of Cost Accounting. The extent to which it is employed should be gauged by the actual or probable benefits to be derived therefrom.

Ed. Note: "Determination of Expenses" and "Allocation of Expenses", the first two articles in this series, are presented in this issue. The remaining articles will appear in our September-October *Anniversary Issue.*

DETERMINATION OF EXPENSES

By **FREDERICK C. RIMMELE,** *Treasurer*
Benedict-Miller, Inc., Lyndhurst, New Jersey

There was a time when industry was simple enough so that the management could, by observation, know which work was profitable and which was unprofitable. As industry became more and more complicated, there was a need for some method of distinguishing between profitable and unprofitable operations. Men, like F. W. Taylor, pioneered in the field of scientific management so that the management and owners of businesses, no matter how far removed from the field of operations, could measure the efficiency of their operations, compare their unit cost of operation, and evaluate various methods of production.

While the blacksmith of yesterday was satisfied to determine the approximate temperature of a piece of steel by looking at the color, today the heat treater demands far greater accuracy and control and therefore, depends on various types of pyrometers to more accurately determine the temperature of the material. So too, the blacksmith of yesterday could tell whether or not a certain job showed him a profit. However, with today's complicated operations in the heat treating plant, it is more difficult to determine whether or not an individual job is carrying its fair share of the expense and, over and above, contributing something to the profit picture. Whereas general accounting is necessary for the overall profit picture and required for tax purposes, it is limited and cannot show whether a particular line or class of work is showing a profit, nor does it show the charge that should be made for each unit in order to produce a profit on it.

To properly set up cost in a heat treating operation, a combination of accounting and engineering together with a knowledge of the peculiarities of the heat treating business is required. We will try in this series of papers to outline a moderate, practical approach to the problem of determining heat treating costs. We describe the first phase of the subject as the, "Determination of Expenses." This consists of

(1) Setting up appropriate accounts to which the many costs of operating the business are charged as the expenses are incurred or accrued.

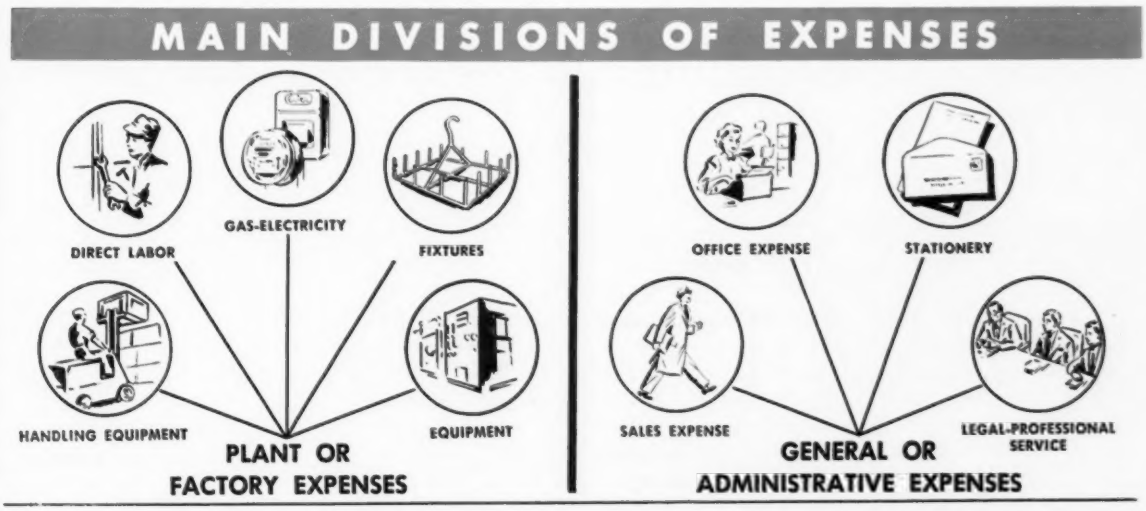
(2) The classification of expenses in accordance with their relationship to the productive operations.

(3) Setting up a summary of expenses to facilitate their application or allocation to productive operations and/or equipment.

Let us start with the General Ledger and proceed to develop our thoughts as to a practical means of establishing reliable costs. The Asset and Liability Accounts should properly reflect the financial condition of the business, but these accounts have little effect upon the determination of costs. The Income Accounts might be simply two; Sales and Other Income, or a detailed breakdown of income by various services rendered may be desirable. We at Benedict-Miller have felt that this was desirable and have expanded the heat treating sales account into a series of income accounts representing revenue from Production Furnaces, Tool Hardening, High Speed Hardening, Straightening, etc.

In developing cost information we are primarily concerned with the expense accounts. These are broken down into two main divisions; namely, Plant or Factory Expenses; and General and Administrative Expenses. Factory Expenses include labor, fuel and power, heat treating materials and fixtures, depreciation, maintenance and repairs, royal-

(Continued next page)



ties, supplies, etc. In developing cost figures we are not only interested in the type of expense, but also in its relation to what is produced. Consequently, the various factory expenses are classified as Direct or Indirect Costs.

The Direct Production Costs are those that can be identified with specific operations of a department or a single unit of productive equipment. On the other hand, the Indirect Costs are more general in nature and must be allocated to productive operations and equipment by appropriate methods. The simplest way of allocating the indirect expenses is to assemble them into as few groups as possible. Each of these groups, which we will call Distribution Accounts, will be comprised of indirect expenses which are similar in their relationship to the productive operations. Care must be used to select the proper basis for allocating each of the distribution accounts to production. This will be covered in the following paper entitled, *"Allocation of Expenses."*

The largest single element of cost in a heat treating plant is labor. It is, therefore, important that payroll records be adequate and complete. The number of employees governs the mechanics of payroll accounting—the smaller concern will find the stationers have on the market manually posted pegboards, which will adequately cover their payroll requirements. On the other hand, a larger concern would employ accounting machines.

The payroll is made up of Direct and Indirect labor. Here again, the Direct Labor is that which can be assigned to specific production operations while the Indirect Labor must be assigned to the appropriate Distribution Accounts for allocation to production.

The payroll clerk or payroll department should prepare, at the end of each month, a summary of the total payroll by direct and indirect departments. Labor allowances (fringe benefits) can be set up as an additional labor cost on the payroll summary. Thus the payroll summary will for each division of the payroll, show the total cost of labor and allowances. The allowances include such things as Social Security Taxes and Unemployment Insurance, Workmen's Compensation Insurance, Hospitalization and other Group Insurance premiums paid by the employer, Vacations and Holiday Pay, and even such items as medical supplies and miscellaneous employee welfare expenses.

Some of these labor allowance items are frequently charged against the months in which they are actually paid. However, many accountants now advocate that they should be spread over all hours worked in the year. This is done by setting up accrual accounts in the General Ledger for such expenses as Vacation and Holiday Pay, and Group Insurance Premiums, and applying them against operations as accrued. Then when the payments are made they are charged to the accrual account. At the year-end a slight adjustment will bring the accrual account into line with the amount of actual expense as finally determined. The payroll provides a natural basis for spreading these labor overhead expenses to the various divisions of the payroll by means of a burden rate calculated on the ratio of total allowances to the total straight time payroll.

A Summary of Factory Expenses may be set up as illustrated in Table I. This summary is simply a trial balance of factory expense accounts, designed to permit classification of the various types of expense for purposes of allocation to productive operations. In the description column are listed the various factory expense accounts. In the "Amount" column to the right is entered the total of each expense account for the period (month or year as the case may be). The next six columns represent Distribution Accounts. The final column to the right is for Direct Expenses. Code letters are substituted for dollars and cents in the illustration to indicate suggested classifications of the various expense accounts.

The total of labor and allowances for each of the various divisions of the payroll are entered in the "Amount" column. These figures come from the Payroll Summary. The direct labor figure is also posted in the "Direct Expense" column; Order and Service, and Receiving and Shipping to Material Handling; Truck Drivers to Outside Trucking; Watchmen and Janitors to Building Occupancy. Maintenance labor is prorated to Building Occupancy, Equipment Maintenance, and Material Handling, on the basis of a summary of maintenance work cards which will be described in the paper on, "Allocation of Expenses." Storekeepers can be divided arbitrarily among Building Occupancy, Equipment Maintenance, and Direct Expense, according to the approximate ratio of supplies and materials carried in stock.

Other Expenses listed are the usual factory expense accounts that appear in the General Ledger of a heat treating business. Others might be added and some listed might be omitted, depending on the size, departmental characteristics, etc., of the business (This same statement also applies to the labor accounts listed). The code letters indicate the suggested classifications of these Other Expenses without the need of comment, except in the case of the last three items on the list.

A depreciation schedule will provide the basis for dividing this expense among the respective accounts as indicated below.

Distribution Account:	*Depreciation on*:
Building Occupancy	Buildings
Quality Control	Laboratory and Testing Equip.
Equipment Maint.	Maint. Machinery and Equip.

Material Handling	Lift Trucks
Outside Trucking	Trucks
Fixed Charges	Productive Equipment

General Insurance is split as follows: Building Occupancy is charged with insurance on the buildings. Outside Trucking is charged with insurance on trucks. The insurance on contents is split among the other accounts by the ratio of insurable values. Said insurable values would be those pertaining to the corresponding equipment listed in the above depreciation classification.

Real estate taxes are charged to Building Occupancy. Personal property taxes are spread among the other accounts and the ratio of insurable values provides a suitable basis of this proration.

Up to now we have been talking about Factory Expenses. General and Administrative Expenses, by contrast, present no particular problem so far as cost determination is concerned. They would be handled in a similar manner in most cost accounting systems. A typical list of these expenses would include such things as the payroll and allowances for office employees, salesmen and officers, legal and professional services, telephone and telegraph, postage, office supplies, etc. General and Administrative overhead is applied to Factory Cost by use of a burden rate. This rate is computed by dividing total General and Administrative Expenses by total Factory Cost.

No cost accounting system can be designed to work equally well in all plants. Differences in the size of plants, types of productive operations, volume of orders handled in relation to tonnage processed, etc., all have an influence on shaping the system to be employed. However, regardless of the characteristics of the plant, it is always desirable to keep the amount of paper work at a minimum. Your plant may require more or less Distribution Accounts than have been suggested in this paper, or it may require Distribution Accounts somewhat different than we have described. In any case, we suggest such accounts be confined to the fewest possible number that will permit proper allocation of indirect costs. ■ ■ ■

TABLE I

SUMMARY OF FACTORY EXPENSES

ACCOUNT	Amount	Building Occupancy	Quality Control	Equipment Maint.	Material Handling	Outside Trucking	Fixed Charges	Direct Expenses
LABOR AND ALLOWANCES:								
Direct Labor and Allowances	A							A
Indirect Labor and Allowances:								
Laboratory (Metallurgical)	B		B					
Inspection	C		C					
Order and Service	D				D			
Maintenance	E	E		E	E			
Shipping and Receiving	F				F			
Drivers	G					G		
Supervision	H		H					
Watchmen	I	I						
Janitors	J	J						
Storekeepers	K	K		K				K
OTHER EXPENSES:								
Treating Materials	L							L
Equipment Maintenance Supplies	M			M				
Building Maintenance Supplies	N	N						
Lift Truck Maintenance and Repairs	O				O			
Heat Treating Fixtures	P							P
Truck Expense (Gas and Oil)	Q					Q		
Truck Repairs	R					R		
Spoiled Work	S		S					
Electric Power	T							T
Fuel (Gas and Oil)	U							U
Outside Work	V							V
Electric, Gas, Water-Building	W	W						
Truck Hire	X					X		
Water	Y							Y
Order Department Forms and Supplies	Z				Z			
Shipping Department Supplies and Expense	AA				AA			
Laboratory Supplies and Expense	BB		BB					
Depreciation and Amortization	CC	CC	CC	CC	CC	CC	CC	
General Insurance	DD	DD	DD	DD	DD	DD	DD	
Taxes	EE	EE	EE	EE	EE	EE	EE	
TOTAL								

This Summary of Factory Expenses shows how many different expenses can be reduced to a few accounts to facilitate allocation. The final step is to run totals on the Distribution Accounts and they are then ready to be allocated to the productive divisions of the plant.

Each item in the Direct Expense column must be charged to production on the basis of the actual consumption of each by the different units of productive equipment. This will be covered in detail in subsequent papers. These direct expenses are included in the summary so that it will actually be a trial balance of all factory expenses and be reconcilable with General Ledger control.

ALLOCATION OF EXPENSES

By **CONRAD H. KNERR,** *Metallurgical Engineer*
Metlab Company, Philadelphia, Pennsylvania

At the risk of repeating some of the remarks made in the previous article, it might be well to say a few words about the objectives of Cost Accounting by way of introduction to our part of this report.

The most obvious uses of cost data are:

(1) To set up price schedules which are applicable to routine work.

(2) To establish cost formulae for estimating, quoting or billing new, unusual or volume production jobs.

(3) To measure performance.

(4) To establish relative efficiencies of various types of equipment and processing methods.

Cost Accounting does not tell management what to do when costs and prices are out of balance, it simply calls attention to them and provides the bases for such management decisions as follows:

(a) To reduce prices, where warranted, in order to increase volume or simply to share economies with the customer.

(b) To increase prices on, or eliminate unprofitable jobs or processes.

(c) To make changes in processing methods in order to lower costs on unprofitable jobs or processes.

(d) To mechanize operations, where possible, in order to reduce labor costs.

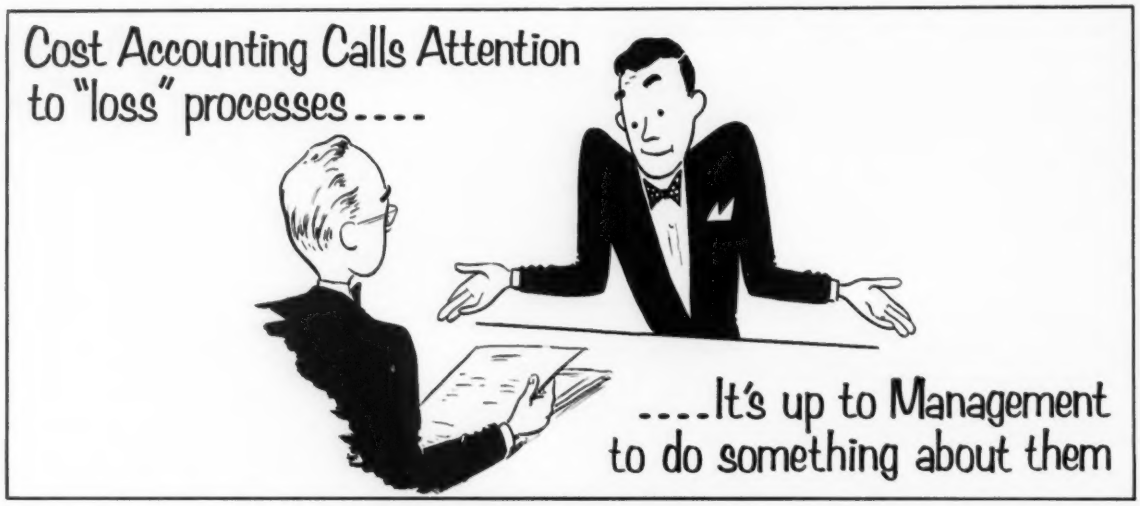
(e) To replace old or obsolete equipment in order to increase productive efficiency.

(f) To correct inefficiencies attributable to personnel.

There are various means of determining costs—some too complicated to be practical, others too simplified to be of value. Either extreme should be avoided.

The extreme in accuracy would involve setting up detailed records and schedules for the distribution of each and every expense to individual production units. Also gas or power meters might be put on every furnace—timekeepers might be stationed throughout the shop to record man hours and equipment hours on every job, etc. A profit and loss statement might be prepared for each production unit. Obviously, such a method would be prohibitive in cost and cumbersome.

The other extreme would be to allocate most or all indirect expenses by a single method, ignoring the difference in relationship of the various expenses to the different productive units and processes—or to allocate expenses entirely by estimate. If this method is carried to its extreme, it becomes worthless, because the resulting unit costs will be overstated in some cases and understated in others.



The Committee's objective is to set up a system that will be reasonable in cost, but will produce data of real value. It is the opinion of the Committee that the most practical and useful tools for cost purposes, in a heat treating plant, are reliable unit costs. This means operating cost figures for each productive unit, whether it be a department or a furnace. These articles suggest steps that can be taken in the development of such figures.

The first article by Mr. Rimmele covered the accounting procedures for setting up general ledger accounts to record the various kinds of expense—

also described was a "Summary of Factory Expenses," which illustrated a procedure of grouping to permit allocation of expenses to production units. There were seven groups of expenses, six of which we call, "Distribution Accounts" and one "Direct Expense." Each distribution account is comprised of expenses which have a common relationship to production. The total of each of these distribution accounts requires allocation to production units in a different manner. As for the group of direct expenses, each item listed in that column must be treated separately.

Before the various types of expenses can be applied to production, it is first necessary to divide the plant into productive departments. For example, a department may consist of one or more pot furnaces used for cyanide case hardening, a salt train used for hardening Hi-Speed steels, one or more gas carburizing furnaces, a bank of general purpose box furnaces, flame hardening equipment, sandblasting machines, etc. In setting up departments the main thing to avoid is incorporating in one department, totally unrelated types of equipment. In a small plant several departments may consist of one furnace each; an induction machine, a sandblasting machine, or a large box furnace.

Having divided the plant into departments, the next step is to design a Departmental Cost Summary on the order of the one shown in Table II*. For this illustration only four departments are used; in actual practice all productive departments would be included. A standard columnar form can be used. The listings in the description column come from the Summary of Factory Expenses (Table I), consisting of the items posted under Direct Expenses plus the Distribution Accounts. You will note, however, that Outside Trucking and Outside Work are omitted from the Departmental Cost Summary. The reasons for this will be explained later.

TABLE II

DEPARTMENTAL COST SUMMARY

COST ITEMS	PRODUCTIVE DEPARTMENTS				
	A	B	C	D	TOTAL
Direct Labor Costs					
Treating Materials and Fixtures					
Electric Power					
Fuel (Gas and Oil)					
Water					
Building Occupancy		SAMPLE FORM			
Quality Control					
Equipment Maintenance					
Material Handling					
Fixed Charges					
Total Factory Costs					
General and Administrative					
Total Operating Costs					

Direct Expenses

Let us now consider suitable methods of applying, or allocating the Direct Expenses and the Distribution Acounts to the productive departments, bearing in mind that the resulting figures would be posted to the Departmental Cost Summary. First we will deal with the Direct Expenses.

DIRECT LABOR COSTS:

The term "Direct Labor Costs" as used here, means wages plus fringe benefits as described in the previous article. It was also explained that the Payroll Summary should be set up to show direct labor costs for the various productive departments. In order to get this detail, some method of reporting direct labor hours by departments is required.

It is seldom practical or economical to have timekeepers in heat treating plants. However, a record of hours worked in the various departments can be kept by the foremen or the individual employees. There can be a work card for each productive employee. It can be the same size as the clock card and designed to provide space for recording hours worked on each day of the week. At the end of the week these cards would be attached to the respective clock cards and thus become the basis for departmental distribution of labor on the Payroll Summary.

At Metlab Company we now require all personnel to record the number of hours spent in doing various jobs or in working on various furnaces during the course of the day. It would require little extra work or expense to have these

(Continued on page 34)

* *Tables in this and the previous article are numbered consecutively for clarity.*

A Work Horse For Industry—

THE WALKING BEAM FURNACE

By **W. A. DARRAH,** *President*
Continental Industrial Engineers, Inc.
Chicago, Ill.

One of the important problems in industry today, particularly in connection with materials heated to relatively high temperatures, is the means of moving or conveying the material continuously while it is being heated. The day is past when the batch type furnace can be economically used for large production. In the batch type furnace, a load of material is first placed in the furnace, heated to the required temperature, and then unloaded. Instead, today's production requirements demand a continuous flow of materials automatically from the loading point, into the hot zone, through the hot zone and out, all without manual operation.

Theoretically, there are many ways of solving such a problem. The work may be placed on trays and the trays pushed through the furnace one against the other. Alternately, the material may be loaded on rails and pushed as in the case of a series of cakes or billets. A hearth of driven rolls is frequently a practical device.

In other designs the conveyor may consist of a series of chains on which the material to be heated is placed. In some cases a wire mesh belt of heat resisting alloy is used to carry the material. All of these types have some particular advantages and also some objections.

Where a conveyor or series of trays are employed, the conveying mechanism must be heated to the operating temperature and removed from the furnace, thus causing a serious heat loss with a resultant relatively high fuel cost, (at times the weight of the tray equals the weight of the useful load.) Alloy chains unless carefully designed may require considerable maintenance. Unequal stretching of chains is also troublesome. The same is true af a wire mesh conveyor belt unless carefully designed and operated within the specifications of the furnace builder. On the other hand the walking beam furnace permits the material to be heated as it is automatically moved through the furnace without having a continuous flow of chain, belt or other material entering and leaving the furnace, to carry away heat needlessly. This type of furnace is particularly suitable for exceptionally heavy loads or very high temperatures.

Furnace Construction

Figures 1 and 2 illustrate diagrammatically two types of construction used. It will be noted that

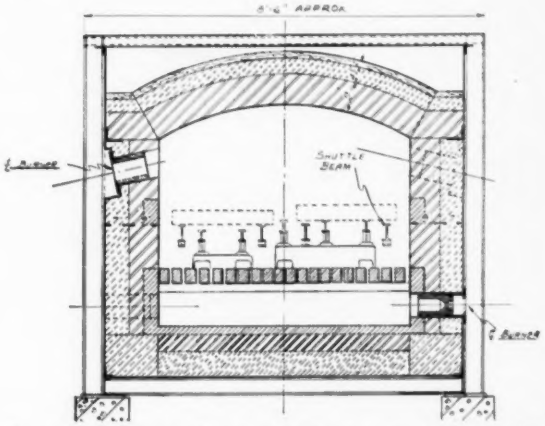


Fig. 1—Typical construction of a Walking Beam furnace using alloy rails to move work through the hearth.

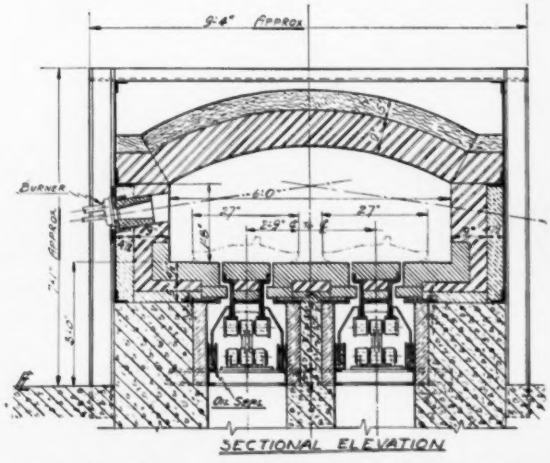


Fig. 2—Walking Beam design utilizing refractory hearth with refractory line "shoes" to move work through the hearth.

the movement of the material is accomplished by means of two sets of rails or beams which may be either alloy or refractory.

There are several types of walking beam furnaces and various designs or mechanisms. Basically, the walking beam furnace consists of a set of beams which continuously rise and fall, and a set of beams which reciprocate forward and backward. Thus the material being moved slides forward on the reciprocating beams until they reach the end of their stroke. The vertically moving beams then lift the load from the reciprocating beams while these beams return to their original position. The cycle is then repeated. In some types, the movement is obtained by having one set of beams travel in an elliptical circuit so that the beams lift the load, travel forward, set the load down on the stationary beams, and then return below the stationary beams to re-engage the load.

For moderate temperatures (up to 1600°F. or 1700°F.) it is quite feasible to design the beams of a good grade of heat resisting alloy. For higher temperatures the upper faces of the beams are frequently constructed of high grade refractories, possibly using alloy as a support and inter-locking means to hold the refractories in place. In a construction of this kind, temperatures well over 2,000°F. are practical. In the case of processing certain aluminum products which require only low temperatures, chrome-iron or relatively inexpensive alloys are permissable.

In well planned installations the walking beam furnace automatically removes the material being heated from the feeding conveyor and moves it through the furnace without manual attention. In the same way the furnace may be integrated with a discharge conveyor so that the heated material will be automatically carried to the succeeding

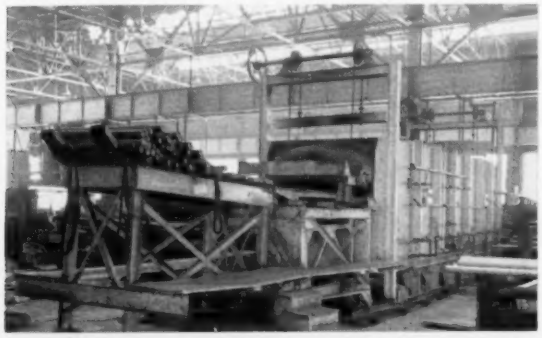


Fig. 3—Walking Beam installation for heating bars prior to extrusion or forging.

operation. This type of equipment is therefore ideally adapted for inclusion in a completely automatic production line.

Heat Applications

Walking beam furnaces readily lend themselves to gas or oil fuel or electric heat. In most cases it is desirable to apply heat both below and above the work which is travelling through the furnace. This is readily accomplished in a well designed furnace and greatly improves the uniformity of heating and of course reduces the time required in the hot zone, and therefore, the size and cost of the furnace equipment. A typical installation is shown in Fig. 3.

It is entirely feasible to maintain a controlled atmosphere in walking beam furnaces, although in this case the fuel should be burned in radiant tubes or muffles to prevent the products of combustion from contacting the material being heated. Naturally this procedure requires a construction in which the mechanism beneath the hearth is entirely sealed to prevent the flow of air upward through the hearth. As a matter of fact such a sealing arrangement should ordinarily be supplied in well designed walking beam furnaces of all types. Such a seal is advisable even when a special atmosphere is not maintained as without a proper seal, the furnace will act as a stack and create a strong draft which will suck air through the bottom of the furnace, thus substantially increasing the heat requirement, and of course increasing the tendency of the material being heated to oxidize. A properly heated walking beam furnace well sealed and well insulated, is an efficient automatic heating device, and at the same time provides a low maintenance mechanism for conveying the material being treated. Thermal efficiencies of sixty percent are not unusual.

Hearth Loading

Walking beam furnaces can be effectively employed over a wide range of materials and capacity. They are supplied in sizes to give a production of 50 or 100 tons per hour while smaller sizes are available down to a loading of a few hundred pounds per hour. The hourly production per unit area of the furnace hearth naturally depends on the specific application, the operating temperature and other factors. Loading rates usually range between 20 lbs. per sq. ft. per hour and 60 lbs. per sq. ft. per hour.

Owing to the close temperature control, which is possible with a carefully designed furnace, temperatures are maintained accurately, heating is uniform, and since the hearth is held at operating temperature continuously, the materials are placed on a hot hearth which materially increases the rate and uniformity of heating. Fuel efficiency is obviously quite high as there is no loss due to conveyors or other parasitic load entering or leaving the furnace. While the walking beam type of furnace is not a universal "Cure-All" it has a very wide field in which it may be successfully employed. It is truly a work horse for Industry. ■ ■ ■

Steel Supplier Has

MODERN PLANT FOR CUSTOMER SERVICE

By **ARTHUR Q. SMITH**
American Gas Association
New York, N. Y.

To supply small manufacturers with their diversified metal requirements, there are many steel warehouses throughout the country catering to these demands. It would not be practical for basic steel mills and large producers of non-ferrous metals to make and stock all the sizes and shapes that are used throughout industry to make a variety of products, or to cut sheet and strip to order. That is for the "neighborhood" steel warehouse where steel is made to measure in a sort of custom tailoring procedure. Steel warehouses might be classified as the department stores of the steel industry. Here a purchaser can find most any type of steel desired and it will be cut to suit his particular needs. Steel warehouses are the only suppliers of cut-to-order steel and will process the steel to meet metallurgical requirements of hardness and other characteristics demanded by the customer.

A steel warehouse is not just a repository for sheets and plates and bars stored and catalogued, it is a busy place full of machinery, production lines, heat treating facilities and many other "tricks of the trade" at hand to meet unusual requests. Steel warehouses are not usually connected with basic steel mills. They are independent companies set up to supply the needs of a community or area with steel in required sizes and shapes.

One of these steel warehouses which goes a little beyond the service usually rendered by such an organization is the Korhumel Steel & Aluminum Co., Evanston, Illinois. They not only serve the Chicago area but their business covers a large part of the middle west. This company also deals in steel, aluminum and phosphor bronze. For the production of shapes and sizes to gage and temper, they have one of the best equipped shops in the country. New modern machines have been installed for cold reduction, shearing, drawing and slitting.

In making cold rolled strips, bright annealing is required to give the material the desired metallurgical characteristics. One of the largest departments in the Korhumel plant is one devoted to annealing. Sixteen bases were built for the annealing process equipment by Continental Industrial Engineers, Chicago, Ill. Set up in units of four bases, they are used progressively for loading, heating, cooling and unloading. For the complete cycle of operation there are four of Continental's "Top Hat," bell type gas-fired furnaces especially designed for cover type annealing, see Fig. 1.

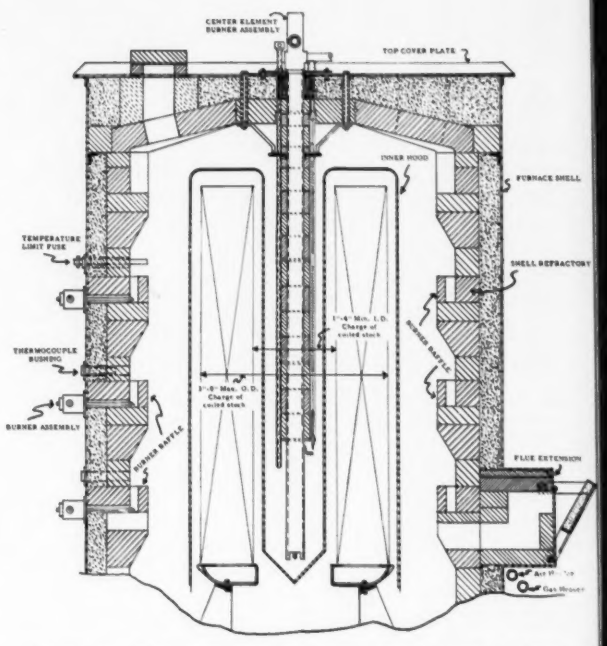


Fig. 1—The "Top Hat" furnace showing burner location, charge and inner hood where the atmosphere surrounds the work.

These furnaces, together with inner hoods which provide for indirect heating and prepared atmosphere protection, together with atmosphere generators, make up the complete gas annealing equipment. A feature of these furnaces is their rapid, uniform heating. The sizes of the coils treated are limited to the dimensions of the inner covers which have a minimum inside diameter of 1′ 4″, a maximum outside diameter of 3′, and a maximum height of 6′ to clear the inner hood when it is placed over the charge. The loaded capacity of each furnace is 16,000 pounds and the average load runs from 12,000 to 15,000 pounds.

When the inner hoods are placed over the charge, as shown in Fig. 2, they are closed at the bottom by a water cooled oil seal. Service pipes for the prepared atmosphere are installed in the bases. The "Top Hat," portable furnace, is lowered over the inner hood containing the charge. These furnaces have 36 burners arranged in rows around the furnace; twelve in the bottom row, twelve in the second row, and six each in the third and the top rows. Each of these burners is a North American, dual valve, nozzle mix burner, using gas and air at 8 ounces pressure, and each has a capacity of 50,000

Btu. The burner on the center element radiant well has a capacity of 200,000 Btu. There are two controls on the outside burners and one on the center burner. Recording pyrometers are connected to thermocouples in the charge. The furnaces are normally operated at a furnace temperature between

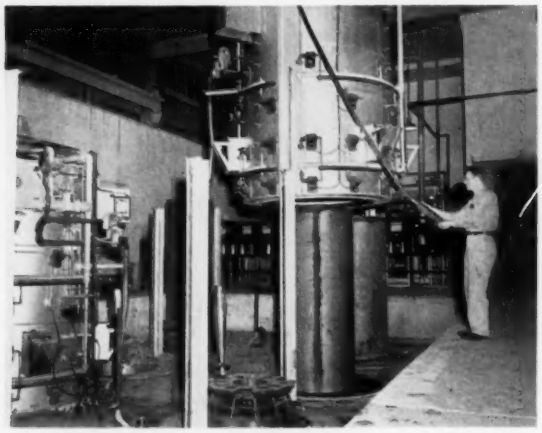


Fig. 2—There are more bases than furnaces which permit continuous operations of loading, heating and cooling at one time. Here a "Top Hat" furnace is being lowered over a charge.

1325° F. and 1425° F. which permits a differential of approximately 75° between furnace and work. Each furnace is equipped with automatic safety controls and Brown Electronik temperature controls together with a visual indication of ignition firing. The annealing time cycle is from 50 to 56 hours.

Gas burners around the furnace have interior baffles to regulate the heat distribution. For greater efficiency and to increase the heat distribution, there is a center burner which is located in the well through the center of the coiled charge. The inner cover is so formed as to provide space for this burner. By means of this arrangement, the charge is heated both from the inside and outside. This accelerates heating as much as 20%.

An inert gas generator to supply the necessary protective gas atmosphere under the inner hoods during the processing operations was also built by Continental. With increasingly exacting demands being made on manufacturers of metallurgical stock, there has arisen a wide-spread demand for a variety of chemically controlled atmospheres for use in connection with various heat treating operations.

A typical inert gas atmosphere analysis being used at Korhumel would be:

CO_2 ..... 4 to 5%	O_2 ..... Trace
CO ..... 9 to 12%	N_2 ..... Balance
H_2 ..... 6 to 12%	Dewpoint 40° F.

After the heating cycle is completed, the "Top Hat" furnace is lifted off and moved to another base that has already been loaded. In this manner the furnaces are in continuous use. The atmosphere is maintained under the hood until the load cools down to at least 300° F. Three stages of the work cycle are shown in Fig. 3.

While some standard sizes are regularly stocked, most of the production at the Korhumel Steel & Aluminum Co. is specifically cut to customers' orders and specifications. For cold rolling and reduction there is a three stand, two high tandem mill having a maximum range of 14" wide and ¼" thick. Slitting, which is one of their major operations is concentrated in one department. There are eleven slitting units, the largest having capacity for 80" strip and the smallest can slit down to ⅛". All gauges up to 5/16" thick can be slit on their equipment. A new 48" slitter has recently been installed having a capacity of 25,000 pound mill coils of either carbon or spring steel. Slit strips can be edge finished in many ways; a square edge, a smooth round edge, a beveled edge or a special shaped edge.

Cold drawing, annealing and hydrostatic testing facilities are available for processing carbon welded or seamless tubing or tube hollows to customer's specifications in standard or intermediate sizes from ⅛" to 3" outside finished diameter. Aluminum, brass, copper and stainless steel tubing can be

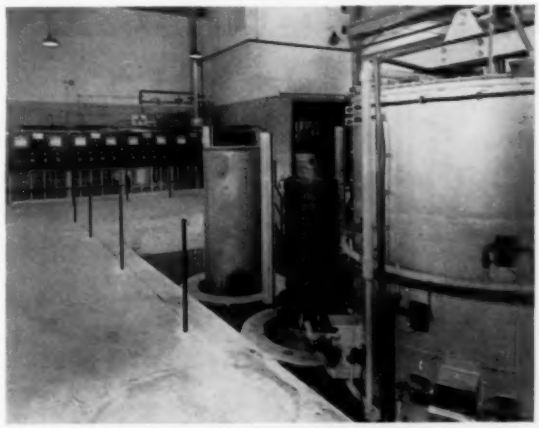


Fig. 3—To the left is a charge covered by the hood under which is the inert atmosphere necessary for bright annealing. In the center is a charge of coiled strip, and in the right foreground a furnace in operation. To the rear is the control board for both furnace temperature and atmosphere control.

drawn to size where no final anneal or heat treatment is required.

Operating 24 hours per day on a 5 day week, approximately 12 million pounds of processed metal is shipped each month. While most shipments throughout the middle west are made by motor truck, a C&NWRR siding into the plant facilitates rail shipments as well as the receipt of raw materials. ■ ■ ■

New Lindberg Division

Lindberg Engineering Company, Chicago, Illinois, has announced the appointment of Mr. L. H. Remiker to head up its newly formed "Field-erected Equipment Division." The new division has been formed to expand Lindberg's existing facilities for specializing in large, field erected industrial furnaces, special machines, and complete production lines. All fabrication will be done in Lindberg's own plants, a one-package operation that eliminates dependence on outside suppliers. Mr. Remiker has been with Lindberg for the past nineteen years serving in the capacity of Chief Engineer.

Other appointments recently announced for the new division include R. A. (Buck) Hastings, sales manager; E. B. Jones, chief engineer; and C. P. Masure, purchasing agent. The three men were formerly with Continental Industrial Engineers, Inc.

Salt Bath Calculator

A unique Salt Bath Heating Time Calculator, used for determining the time required to heat steel sections in a salt bath, has

been developed by Ajax Electric Company, 940 Frankford Ave., Philadelphia, Pa. The pocket-sized slide chart can be used to calculate the heating-up time of steels, up to 3 inches in diameter, to any temperature from 400° to 2400°F. This temperature range coincides essentially with the present lower and upper practical limits of salt bath processing.

Determination of the time necessary to heat up a piece of steel of a given size to a given temperature with the Ajax Calculator requires a single setting of the slide. Bath temperature is set over the arrow, and heating-up time is read directly beneath the arrow in the window for the proper steel size.

Bar Stock Heating

A new mechanical development, which reportedly puts end-heating of bar stock for upsetting on a completely automatic basis, has been announced by Gas Appliance Service, Inc., 1211 Webster Ave., Chicago, Ill., for use

with the company's "Roto-Flame" furnace.

This consists of a mechanical hopper-feed unit, mounted at one end of the furnace conveyor, designed to automatically supply stock to the latter. Bars are then carried through the heat zone at a speed to satisfy the desired heating cycle.

Among the many features claimed for this equipment, which works on the "high speed" or "high head" heating principle, are: greater heating uniformity, greater plasticity in the heated metal, less scale, minimum floor space, and increase of production up to 100 per cent with same labor.

Furnace Loader

The Industrial Heating Equipment Co., 3570 Fremont Pl., Detroit 7, Mich., has announced the

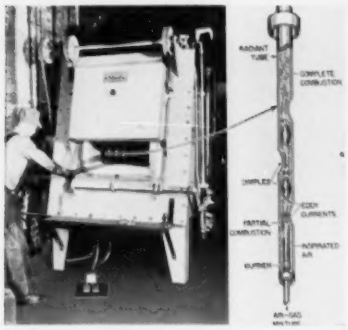
availability of a new "Metering Loader." It is reported that 100 to 5000 lbs./hr. of miscellaneous small parts can be metered to any continuous equipment through variable speed drive having 20:1 ratio.

The loader can be made to distribute work evenly across the full width of the conveying mechanism on the equipment being fed. It will handle parts as small as 1/16" diameter. The standard hopper, which empties itself, holds up to 1000 lbs. of average size bolts weighing approximately 200 lbs./cu. ft.

Floor area of 7'9" long by 4'6" wide is required for the 18" wide belt which loads at a height of 33" and discharges at 7'. Smooth floor space and electric service are the only installation requirements of the new unit although custom made units are available to fit special conditions.

New Gas-Fired Radiant Tube Atmosphere Box Furnace

The first large scale application of radiant tubes to tool-room-size furnaces was reportedly done with Lindberg Engineering



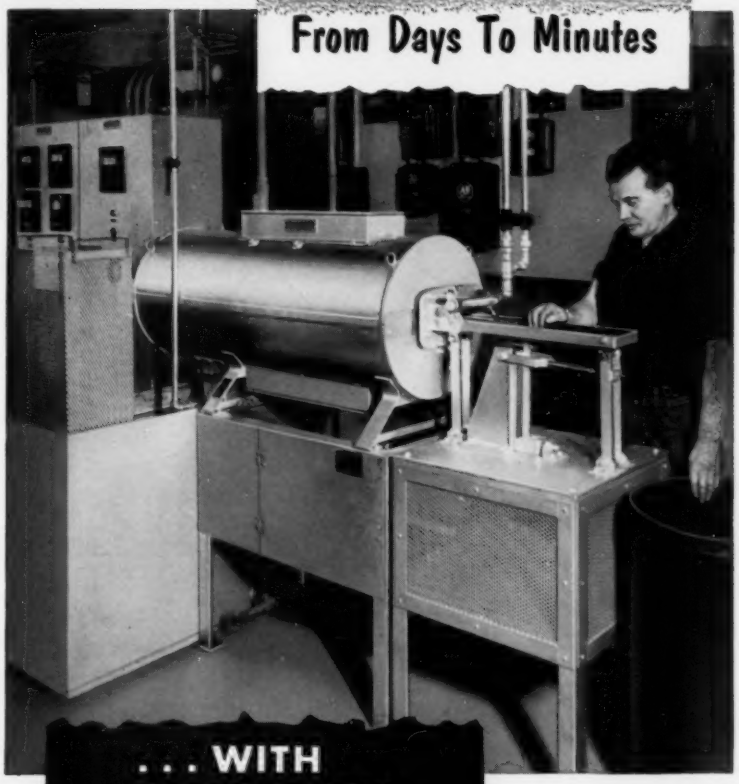
Company's new gas-fired radiant tube atmosphere furnace. The new unit is suited for heat treating virtually all production and tool steels, except high-speed, where it is essential to keep the work scale and decarburization free.

Previously, the problem in the use of a relatively short straight tube was that if a premixed gas-air were used, the flame would be too short and hot as combustion would be instantaneous and extremely high temperatures would result at the burner with much lower temperatures along the rest of the tube. Also, if the usual radiant tube burner was used combustion would not be anywhere near complete in such a short length.

In the new furnace, this problem was solved in two steps. First, the center stream instead of being 100% gas was a mixture of gas and a relatively small amount of air, insufficient for complete combustion. Second, indentations approximately 1" deep and on 6" centers are placed around the circumference of the tube, top to bottom. As the stratified stream of gas and air mixture and the straight air surrounding it pass up the tube, the first "dimple" sets up an eddy current which mixes the air with some of the air-gas mixture, accelerating the combustion rate.

(*Continued on page* 16)

Hardening Time Cut From Days To Minutes



. . . WITH HEVI DUTY SHAKER HEARTH FURNACE

Master Lock Company

SPEEDS PRODUCTION WITH THIS NEW FURNACE

Heat treating of an 80 pound batch of small springs required two days when hardening in charcoal filled containers. This process was not only slow but also costly due to a high percentage of rejects.

Now in a Hevi Duty Shaker Hearth Furnace, a similar batch is "bright" hardened in 75 minutes. Each spring receives uniform heat treatment without distortion thus cutting production costs. This furnace has been designed to solve your problem of heat treating small parts.

HEVI DUTY®

Learn more about this modern production tool and the way it can help you.

WRITE FOR BULLETIN HD-850.

HEVI DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces... Electric Exclusively

Dry Type Transformers *Constant Current Regulators*

As the streams move further upward, additional "dimples" continue the mixing until completed.

This new design made it possible to suspend the tubes along the sides of the furnace chamber eliminating the need for great strength required for horizontal tubes. The tubes are made of thin walled Inconel. The light straight tubes give maximum heat transfer rate through the tube wall and minimum internal tube temperature for long life. All tubes are fired at the lower end and are readily removable through the furnace arch without the need for cooling the furnace or interrupting the operations.

Input Controller

The "Truetemp" input controller, which is added to an existing industrial "on-off" temperature control system and said to maintain heating temperatures as close as ±0.2°F. has been developed by the Winslow Company, 9 Liberty St., Newark 5, N. J.

The new instrument reportedly can be used with all heating systems, regardless of size, operating temperature, or fuel, provided the present control instrumentation is thermocouple actuated.

Because of the growing trend toward more critical heat processing requirements, heating system deviations from a specified control point must be minimized as much as possible. In general, any type of control equipment will hold the average temperature of a system close to the desired setting. But even with excellent industrial thermocouple actuated on-off controls, deviations as high as ±30°F. from the processing temperature may occur at a given instant. This is a consequence of normal thermal inertia, since heat flow in or out of the heating system cannot stop or change direction at the exact moment the temperature controller calls for action.

It is claimed that with insertion of the input controller into an existing control system, the control point is dynamically

shifted in direction and magnitude so as to counteract the effects of thermal inertia. By thus anticipating thermal lag, under or over shooting is eliminated and a straight line graph results on the temperature recorder chart. Such laboratory type temperature control, effected with normal industrial heating equipment and the Truetemp, has been successfully used in heat treating, heat sealing, injection molding, wire drawing, ceramic kilns and laboratory furnaces.

New Flange-Type Immersion Heaters

Single and double flange-type heaters have been added to General Electric's Calrod immersion heater line, it was announced recently by the company's Industrial Heating Department.

The new heaters, designed to operate on either a-c or d-c circuits at 115 or 230 volts, can be used in water baths, cleaning tanks, quench tanks, and similar equipment.

Offering a high watt density, the heaters are formed by bending a Calrod tubular unit into hairpin shape, the ends of which are brazed into a flange. A silicone seal and porcelain insulator are incorporated at the heater's terminal ends as a protective measure against vapors and liquids, and to provide electrical insulation.

Tempilstiks°

quick, simple, accurate way to tell temperatures

It's this simple: mark the workpiece with the proper Tempilstik°. When the mark melts, the specified temperature has been reached.

use like a crayon

to control working temperatures in:
- welding
- flame-cutting
- tempering
- forging
- casting
- molding
- drawing
- straightening
- heat-treating in general

$2 each gives up to 2000 readings

Available in these temperatures (°F)				
113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
238	388	900	1450	2000

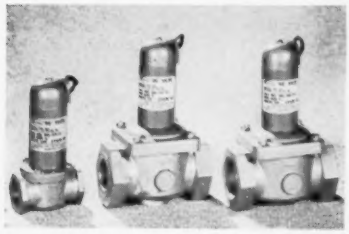
Also available in pellet or liquid form

FREE —Tempil° "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

Metal & Thermit Corp. 100 E. 42nd Street, New York 17, N. Y.

New Line of "DO" Solenoid Valves

Eclipse Fuel Engineering Company, Rockford, Illinois is now producing a complete line of "DO" (diaphragm operated) solenoid valves. These valves, designed for stand-by control of fluid flow and for automatic cycling operations on heat treating furnaces, and other metalworking



equipment, are now available in pipe sizes from ⅜ to 1½ in. The valves are used for the control of air, water, oil, natural, manufactured, propane and butane fuel gases, and sulphur dioxide gas. They will reportedly operate on line pressures as high as 150 psi and as low as ½ in. of water. Ideal cycling range for these valves is from 40 to 60 cycles per minute.

Valves are supplied with aluminum bodies for gas and air service and brass bodies for oil and water service. Valve seats and armature pilot plungers are stainless steel. The ⅜-in. through ¾-in. sizes are Factory Mutual approved to maximum 15 psi pressures.

Operating advantages of these valves are said to include: low power consumption, simplicity of construction, noiseless operation, coil interchangeability, high operating efficiency, wide choice of control, maximum shut-off safety and ease of maintenance.

Stock coils are rated at 7 watts maximum. They are available for 115 and 230 volts in either 50 or 60 cycles. (Coils for other voltages and cycles can be furnished to order.) Valve has only two moving parts—the solenoid plunger and the synthetic rubber diaphragm. Several conventional parts such as valve guides,

(*Continued on page* 18)

MISCO
EXPERIENCE
is your
INSURANCE

In

ANNEALING HOODS
CARBURIZING BOXES
MALLEABLEIZING BASKETS

AND OTHER

HEAT-TREATING CONTAINERS

MIS-COR
DESIGNS

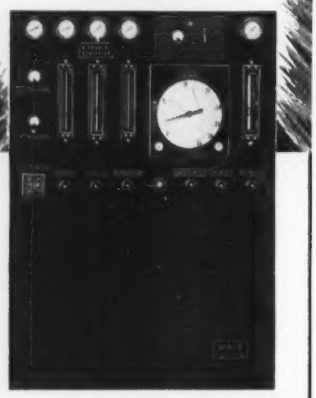
ADD **STRENGTH**

REDUCE **WEIGHT**

MISCO FABRICATORS, INC.
Designers, Builders, Fabricators of Heat Resisting Alloy and Stainless Steel Equipment

1999 GUOIN STREET • DETROIT 7, MICHIGAN
TELEPHONE LORAIN 7-1545

FURNACE BRAZING OF STAINLESS STEEL



NITRONEAL GAS GENERATOR

. . . Produces pure nitrogen with a controllable hydrogen content that can be varied at will and maintained at any percentage from .25% to 25% to best suit work in furnace.

Used for bright annealing, heat treating, and furnace brazing of stainless steel, low and high carbon steels and non-ferrous metals.

- Fully Automatic
- No Operating Personnel Required
- No Explosion Hazard
- 30% Less Costly than Dissociated Ammonia.

Units available in 100 C.F.H. to 10,000 C.F.H. capacities.

Write for Booklet No. 21

BAKER & CO., INC.

113 ASTOR STREET, NEWARK 5, N. J.

NEW YORK • SAN FRANCISCO • LOS ANGELES • CHICAGO

seat ring gaskets, pilot valve-cages and coil retaining screws, washers and springs have been eliminated in the "DO" valve.

New Subsidiary

Alan D. Dauch has been appointed vice president of sales of Salem-Brosius, Inc., Pittsburgh, and of its recently acquired subsidiary, the George J. Hagan Co., Pittsburgh. In addition, Mr. Dauch will continue as vice president in charge of activities of the Hagan organization.

John W. Holzwarth is the manager of sales of heavy heating furnaces for the steel and nonferrous metals producing and fabricating industries and of all mechanical products. Mr. Holzwarth will have headquarters at the company's general offices in Salem, Ohio.

Charles H. Schwerin was named manager of sales of rotary hearth furnaces and all heat treating furnace equipment. His headquarters will be at the offices of the George J. Hagan Co., Pittsburgh.

Ward A. Wickwire, Jr., president of Salem-Brosius, Inc., and George J. Hagan Co., stated that the two organizations have pooled all engineering and production facilities. Sales activities are being reorganized on a company-wide basis.

Alloy Casting Institute Elects Officers

Mr. C. K. Lockwood, vice president of the Stainless Steel & Alloys Division, Shawinigan Chemicals Limited, Montreal, was elected president of the Alloy Casting Institute at the close of the Institute's 14th Annual Meeting on June 29th. He succeeds Mr. G. A. Baker, vice president of the Duriron Company, Inc., Dayton, Ohio. Technical association of the high alloy foundry industry, the Alloy Casting Institute comprises most of the nation's leading stainless castings producers.

Mr. Thomas Rutherford, The Midvale Company, Philadelphia, Pa., was elected to the office of vice president of the Institute, succeeding Mr. Lockwood, who served in this capacity last year. Mr. E. A. Schoefer, Mineola, N. Y., was reelected executive vice president and treasurer.

Three new members were named to the Institute Board of directors. They are Mr. C. M. Ruprecht, president, the Electro-Alloys Division, American Brake Shoe Company, Elyria, Ohio; Mr. B. B. Evans, Sales Manager, Empire Steel Castings, Inc., Reading, Pa.; and Mr. J. D. Hagans, Sales Manager, The Ohio Steel Foundry Co., Springfield, Ohio.

During the three-day meeting, reports of ACI's research work on cast heat-resistant and corrosion-resistant alloys were presented. The Institute conducts most of this research at the Battelle Memorial Institute and Ohio State University, both in Columbus, Ohio.

Cyanamid Appointment

Mr. James B. Hatch joined the Metal Chemicals Dept., it was announced today by the American Cyanamid Company's Industrial Chemicals Division. He will handle sale of Cyanamid's metal chemicals for the metals industry.

Mr. Hatch, a graduate of the University of Illinois, received a B.S. degree in General Engineering in 1943, and a B.S. degree in Metallurgical Engineering in 1953.

Mr. Hatch, who joined the company in April 1954 as a sales trainee, worked for Sylvania Electric Corp. prior to joining Cyanamid.

New Representative

The Stanwood Corporation, Chicago, Ill., has announced the appointment of a new sales representative for the Dayton, Ohio area. Fred L. Stork, 808 Wellmeier Ave., Dayton, will service the area for users of Stanwood fixtures, retorts and other heat treating equipment.

(*Continued on page* 20)

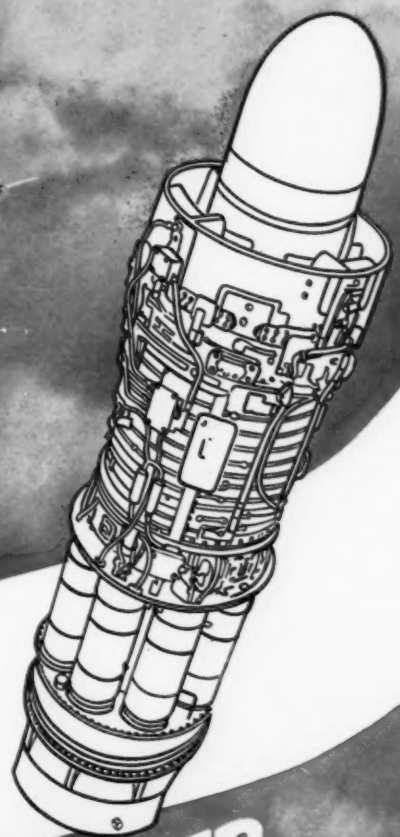
Heat Treating

AN IMPORTANT FACTOR IN MAKING

Jet Engine Parts

The parts that go to make up a jet engine call for heat treating techniques as new as they are varied. Drever's long experience, through its own commercial heat treating division, has provided welcome solutions to many new problems of furnace design encountered in this field. Drever builds heat-treating furnaces of many types, with special adaptability to treating Stainless Steels of the 300 and 400 series, as well as Nimonic, etc.

Drever furnace application engineers will look forward to the opportunity of discussing your problem with you.



FURNACES FOR

BRIGHT ANNEALING AND BRIGHT HARDENING OF SMALL PARTS
CONTINUOUS ANNEALING OF WELDMENTS, STAMPINGS, ETC.
SINTERING AND INFILTRATION OF POWDERED METALS
BATCH OR CONTINUOUS TYPE FOR STRESS RELIEVING

Also installations for caustic descaling including quench and acid dip tanks

DREVER CO.

720 E. VENANGO STREET
PHILADELPHIA 34, PA.

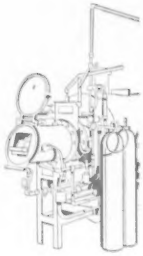
8

How To Cut Costs in Metal Treating!

...Use BARRETT® BRAND Anhydrous Ammonia

–and you have the most economical source of dis-associated hydrogen and nitrogen for metallurgical uses. 6,750 cubic feet of Hydrogen and Nitrogen from a single 150 lb. cylinder! And you don't have to stock up heavily–our coast-to-coast delivery service will give you *fast* delivery on 150, 100 and 50-lb. cylinders.

Check the many jobs Barrett Ammonia can do so well–then order today!



Do You Use Anhydrous Ammonia for *These* Important Jobs?

- Protective atmosphere for bright annealing, brazing and powder metallurgy.
- Nitriding of alloy steels and carbonitriding (Dry Cyaniding) for treatment of steel.
- Case hardening of iron and steel with case depths up to 0.025 inches.
- Sintering of metal powder compacts.
- Augmenting corrosion–resistance treating for aluminum, magnesium, other light metals.
- As a solvent in making electrolytes for electrolytic recovery of salts.

GET THIS VALUABLE HELP!

Technicians specially trained in the use of Anhydrous Ammonia for the above and other metallurgical uses are ready to help you. No obligation. Call or write today! Also–valuable handbook available on the use and economical handling of Ammonia. Request it.

Look for the green cap!

First in Ammonia Since 1890

NITROGEN DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

NEWS TO HEAT TREATERS (cont'd)

Open Link Conveyor Belt

A new design belt conveyor featuring an open-type link has been announced by Standard Alloy Co., Inc., 1679 Collamer Rd., Cleveland, Ohio. The new open

link design is said to make the belt readily adaptable to annealing, normalizing, stress relieving, and draw furnaces where circulation of the heat in the furnace is essential. The belt conveyor is available in regular widths from 18-in. up to 60-in. and is adaptable to comparatively long spans, operating in temperatures of 1800° F.

Tempil Expands

The Tempil Corporation recently announced a consolidation of all facilities at 132 W. 22nd St., New York, N.Y., where previously only its plant and laboratory were located. This move of its offices and shipping department includes the provision for more space at the new address.

Pipe Annealing Furnaces For Jones & Laughlin Steel

Two new heat treating furnaces for pipe annealing will be constructed for Jones and Laughlin Steel Corporation at its Aliquippa Works, according to Rust Furnace Company, the designer-constructor.

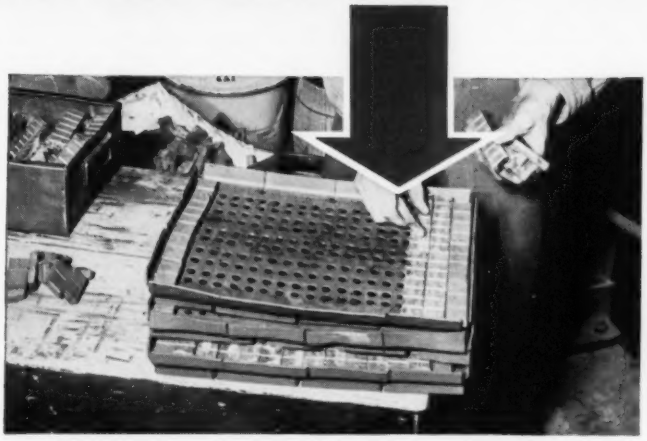
Now in design, the furnaces, of the continuous walking beam type, will serve the Aliquippa Works' new Seamless Tube Specialties Department. They will be 54' 9" wide by 45½' long with 6' height in the heating zone and 4' height in the soaking zone. Coke oven gas will be used as fuel with natural gas as standby.

(Continued on page 37)

At General Magnetic Corporation, 10001 Erwin Street, Detroit, Michigan, magnets are brought up to heat, 2400° F. in one hour, soaked 20 minutes, then cooled in 10 minutes to 300-400° F. They ride in Inconel trays with Inconel covers to protect them against direct heat.

UP to 2400° F.

DOWN to "Handling cool" 6 times daily



Yet Inconel trays and covers serve a full six months treating Alnico magnets

After discharge trays are allowed to cool to handling temperature, then reloaded 6 to 7 times daily. Expansion slots help reduce stresses created by cycling between temperature extremes. Design and fabrication by Misco Fabricators, 1999 Guion St., Detroit 7, Michigan.

When metals cycle between 2400° F. and room temperature 6 times daily . . . they lose heart quickly.

Yet that . . . and corrosive furnace atmospheres to boot . . . is what equipment for heat treating Alnico magnets must withstand.

Until Inconel® trays and covers were tried, at General Magnetic Corporation, no material proved satisfactory. Now, with Inconel, six months or more of service is obtained.

These trays and covers were made by Misco Fabricators, who specialize in heat treating equipment. They use Inconel extensively where, as in this case, requirements are rigorous.

Inconel retains good strength at high temperatures. It also shows little or no effect from carburizing or nitriding furnace atmospheres. Then, too, it is readily fabricated and repaired.

These are the reasons you can expect a well designed piece of Inconel equipment to show low overall cost . . . and give little trouble. At very high temperatures, it often is the only practical material to use.

You'll find many suggestions on practical ways to make Inconel heat treating equipment in "Keep Operating Costs Down . . . When Temperatures Go Up." If you would like a free copy of this booklet, write:

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

Inconel Incoloy . . .

INCO TRADE MARK

Nickel Alloys
for long life at high temperatures

Sound advice...

"LOOK-before you LEAP!"

Only the Com

And T

If you are considering plans for expansion of present heat treating facilities or new plant construction, "Look Before You Leap" —check with an MTI commercial heat treater.

The chances are that you will find a Commercial Heat Treater near your plant with the facilities, equipment, skill and experience to perform "custom-tailored" heat treating operations required for your prime or sub-contract rearmament program work.

Eliminate Personnel Problems

All members of the Metal Treating Institute are specialists with complete service facilities under one roof. They offer you a variety of skills — handling and processing all types of heat treating from simple stress relief to delicate controlled atmosphere hardening, cyaniding, etc. This experience and know-how would be practically impossible for you to duplicate under today's conditions.

Avoid Future Waste

The recent post-war years proved the wisdom of using established facilities in your locality. Many expanded plant departments and new construction had to stand idle or be scrapped when the crisis passed. It is good business to avoid possible repetition. Remember, even if only Government money is involved at the present time, you will pay part of the cost eventually. Conservation of Government spending is always of benefit to you.

A Good Policy

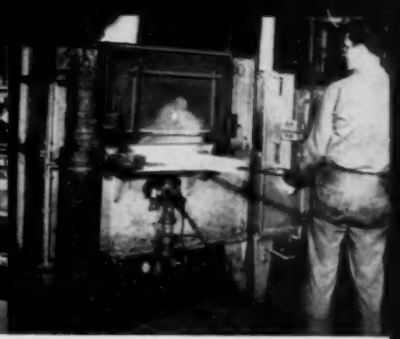
When faced with heat treating problems, or the need for heat treating services, contact the Metal Treating Institute or any MTI member listed on the facing page. All detailed inquiries receive prompt attention.

National Trade Association

COMMERCIAL HEAT TREATERS

METAL TREATING INSTITUTE

271 NORTH AVENUE — NEW ROCHELLE NEW YORK



cial Heat Treater Can Give You COMPLETE Service . . .

e's a Heat Treating Specialist Near Your Plant!

ALABAMA

Southern Metal Treating Co., Inc.
3131 10th Ave., North, Birmingham 4

CALIFORNIA

Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Malloy Heat Treating Co.
11648 So. Atlantic, Lynwood
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8
Valley Metal Treating Co.
355 So. East End Ave., Pomona

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Senecca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
Lindberg Steel Treating Co.
1975 No. Ruby St., Melrose Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
American Metal Processing Co.
12000 East Nine Mile Road, Van Dyke

MINNESOTA

Metallurgical, Inc.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and IaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark
Temperature Processing Inc.
228 River Road, North Arlington
Metro Heat Treat Corp.
9 Victoria Place, Ridgefield

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E., Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave.,
Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Allied Metal Treating Corp.
Highway K & 60th Street, Kenosha
Hushek Metal Processing Co.
1536-40 West Pierce Street, Milwaukee 4
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Heat Treating Co.
1333 West Pierce Street, Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1635 Murray Ave., Racine
Spindler Metal Processing Co.
2338 Mead Street, Racine
Wesley Metal Treating Co.
2320 Mead Street, Racine

INSTITUTE NEWS

1954 Annual Meeting

The Hotel Sheraton, Chicago, Ill., will be the site of what is expected to be the largest Annual Meeting of the Institute ever held. The meeting program for the days October 29 to 31 is in its final stages at this writing and includes two key speeches on topics important to all members.

The Hotel Sheraton

Colonel Leslie S. Fletcher, Director, Research Fund, American Society of Tool Engineers will present a talk on the aspects of possible cooperation between the ASTE and MTI Research Funds which might lead to work of mutual benefit to both societies. A representative of The Carpenter Steel Company will present an equally interesting talk on the matter of how tool steel manufacturers and commercial heat treaters can achieve greater cooperation in the specification and treatment of tool steels.

The Nominating Committee is underway on its selection of nominees for officers and directors, always an important part of annual meetings.

A new General Electric Company film entitled "Productive Maintenance" is also scheduled for showing and contains valuable information of equipment operation.

This year's meeting will also include the first presentation of an *Annual Metal Treating Institute Achievement Award* to the author of the most outstanding lecture presented at the 1953 Annual Meeting or 1954 Spring Meeting, or for any paper appearing in *Metal Treating* between November-December 1953 and September-October 1954.

Another innovation in effect at this meeting will be the functioning of a Social Committee under William S. Cwik, State Heat Treat, Inc., Grand Rapids, Mich.

Member Expands

Hollywood Heat Treating Company, Los Angeles, California, has recently acquired a building adjacent to its present facilities and are installing new equipment which will at least double their commercial heat treating capacity.

Executive Secretary Visits West Coast

During July Secretary Herington had an opportunity to visit members in the San Francisco and Los Angeles area which proved both informative and enjoyable.

Messrs. Ben Berlien, Don Edwards and Thad Eaton provided a superb brand of California hospitality and while in Los Angeles the Southern area provided adequate competition, along the same lines, to their Northern neighbors.

On Thursday, July 1st, a group luncheon was held at The Hotel Ambassador, Los Angeles, at which the following members were present: A. E. Leidig, Richard Smith, Sr., Richard Smith, Jr., Daniel Malloy, R. W. Fish and W. W. Farrar. During the luncheon it was suggested that such a meeting be held regularly and that an official Los Angeles Chapter be established.

Member Appointed to SBA Council

Mr. A. D. Bach, New England Metallurgical Corp., South Boston, Mass., has been appointed a member of the National Council of Consultants of the Small Business Administration. In this capacity Ad Bach will work closely with and offer recommendations to SBA Administrator, Wendell B. Barnes.

Two Members Added to Institute Roll

On June 1st two new member companies were added to the Institute roll bringing the total membership to eighty-two. The new members and their designated representatives are:

Allied Metal Treating Corp.
Kenosha, Wis.
Representative Mr. Harold R. Wesley

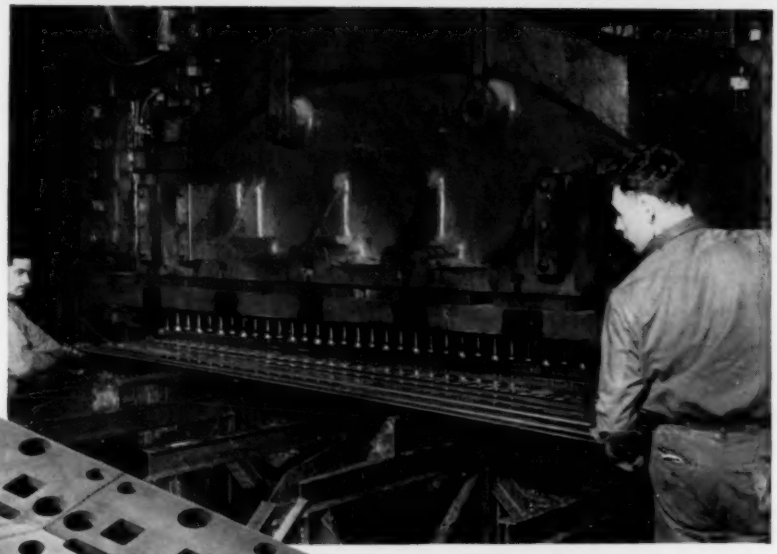
Malloy Heat Treating Co.
Lynwood, Calif.
Representative Mr. Daniel F. Malloy

Tool Steel Topics

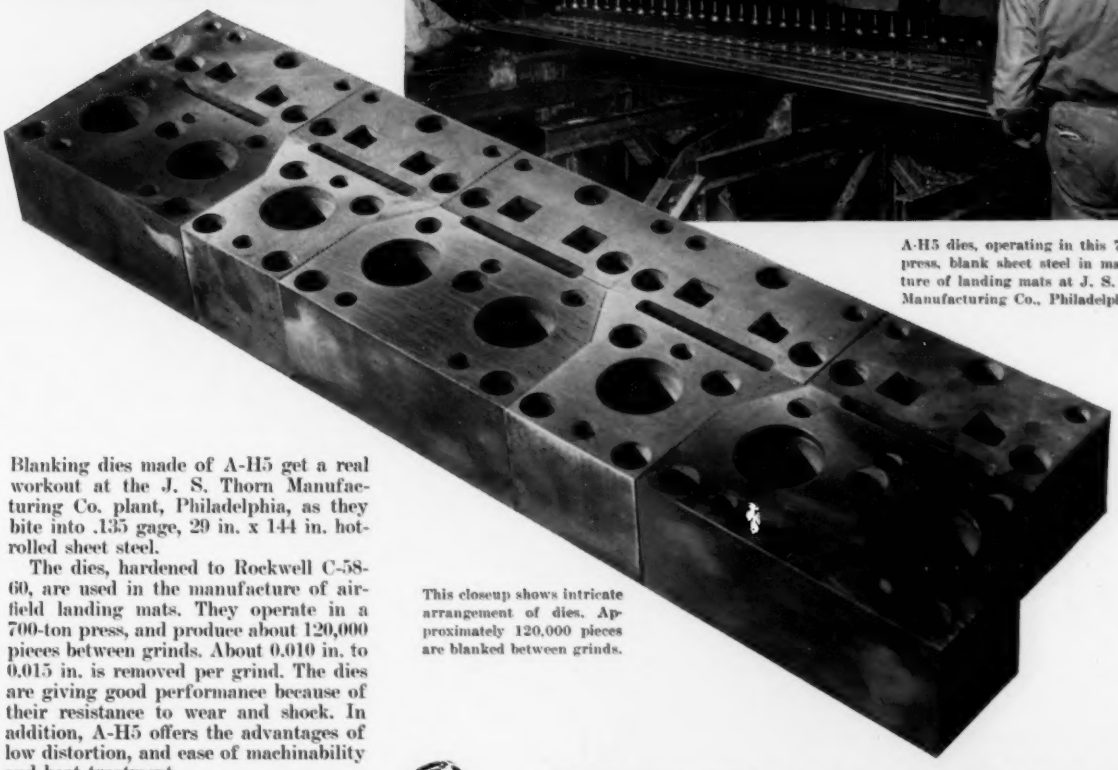
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Dies of A-H5 Give Good Service in Turning Out Landing Mats



A-H5 dies, operating in this 700-ton press, blank sheet steel in manufacture of landing mats at J. S. Thorn Manufacturing Co., Philadelphia.



This closeup shows intricate arrangement of dies. Approximately 120,000 pieces are blanked between grinds.

Blanking dies made of A-H5 get a real workout at the J. S. Thorn Manufacturing Co. plant, Philadelphia, as they bite into .135 gage, 29 in. x 144 in. hot-rolled sheet steel.

The dies, hardened to Rockwell C-58-60, are used in the manufacture of airfield landing mats. They operate in a 700-ton press, and produce about 120,000 pieces between grinds. About 0.010 in. to 0.015 in. is removed per grind. The dies are giving good performance because of their resistance to wear and shock. In addition, A-H5 offers the advantages of low distortion, and ease of machinability and heat treatment.

A-H5 is our 5-pct-chrome air-hardening tool steel. It's an easy tool steel to machine, too, as it can be annealed to 212 Brinell.

Typical Analysis

Carbon	1.00	Molybdenum	1.10
Manganese	0.60	Vanadium	0.25
		Chromium	5.25

A-H5 is an economical steel for dies, punches, and forming and blanking tools. It is well liked wherever safe hardening, low distortion and increased resistance to wear are required. Why not give it a trial? Your nearest Bethlehem tool-steel distributor can supply you promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Avoid Premature Failure—Don't Make Shock Tools Too Hard

As a rule, shock-resisting tool steels perform best when they are hardened to Rockwell C-55/C-60. At such a range, there's a good compromise provided between toughness and resistance to wear. When premature failure occurs in these grades, it can usually be traced to excessively high hardness.

But rather than harden shock-resisting steels to Rockwell C-59 or higher, when such hardnesses are required, it would be better to select a carbon tool steel.

When greater wear-resistance is required, the chrome-tungsten grades of shock-resisting tool steel may be carburized to provide a hard case and a shock-resisting core. The carburized case used for this type of shock-resisting steel should be only 0.010 deep. This method can be used to good advantage when you are manufacturing such items as reamers, swaging dies and master hobs.

quality in the finished product is the major requirement and operating cost is secondary. It is highly significant that the great majority of quality tool manufacturers are now using salt bath furnaces. Any type of steel, whether tungsten, molybdenum or cobalt can be hardened with equal ease and safety, merely by a change in the temperature setting of the furnaces. Internal stresses in the finished piece are negligible because of the common use of salt quench furnaces, and as a result, cracked tools are a rarity.

The equipment consists usually of a battery of four furnaces, but sometimes there are as many as six involved. The following operations are required on practically all tools:

1. Preheat to 1550-1650° F. (1 or 2 furnaces)
2. High heat 2200-2375° F.
3. Salt quench (1100-1200° F.)
4. One or two draws (1050-1100° F.)

If the tools are to be nitrided, an additional furnace unit is reguired.

Cyaniding

Cyaniding is a process for imparting a shallow, file-hard case on the surface of steel in a relatively short time. It is done in a bath containing from 15 to 30% of sodium cyanide. The time temperature penetration curve for this treatment flattens definitely after one hour and a .010" case is about the maximum which can be expected. The case is due to a combination of nitriding and carburizing which accounts for its extreme hardness.

In general, cyanide is applied for a shallow wear resisting surface. Such articles as screws, grease fittings, business machine parts, roller chain components, dental burrs, sewing machine parts, shafts, bolts and hundreds of other items which must have wear resisting properties are frequently given this cyaniding treatment. It is also used for the hardening of heavy duty gears in the automotive field, where the additional high surface hardness is of great benefit. Cyanide baths are also used for reheating carburized work.

REEVELEC
ELECTRONIC
HEATING
EQUIPMENT
for every metal treating application!
Whether you need a ½ KW stock generator or a 50 KW custom-made unit— Reeve can supply it.
Reeve builds industrial electronic heating equipment exclusively . . . designed and constructed from start to finish for your particular application, including presses, work tables and any other accessories needed to give you the maximum possible production.
Reeve engineers will design the best unit for your particular need. Write for additional information to:
REEVE ELECTRONICS
619 W. LAKE ST.
CHICAGO 6, ILL.

Carburizing

Liquid carburizing is similar to gas or pack carburizing in that carbon is added to the steel's surface to the desired depth. Again, sodium cyanide is the basic ingredient of the bath and case depths equal to those secured by gas or pack carburizing can be obtained. Somewhat higher temperatures can be employed; 1750° F. is commonly used and some installations operate at 1800° F. The rate of penetration increases with temperature and higher temperatures are therefore preferred. This decreases the time required at temperature, for example, a case depth of .040" is produced in 2 hours with a bath operating at 1750° F.

Basket loading is common for liquid carburizing and the density of loading is limited only by mechanical factors. One furnace can be used to obtain different case depths simultaneously without impairing furnace efficiency and is an important consideration. A carburizing bath always operates with a heavy carbonaceous scum on the surface which provides good heat insulation. The pot is made of welded steel plate and furnaces of large size, some fully mechanized, are in operation today.

Interrupted Quenching Treatment

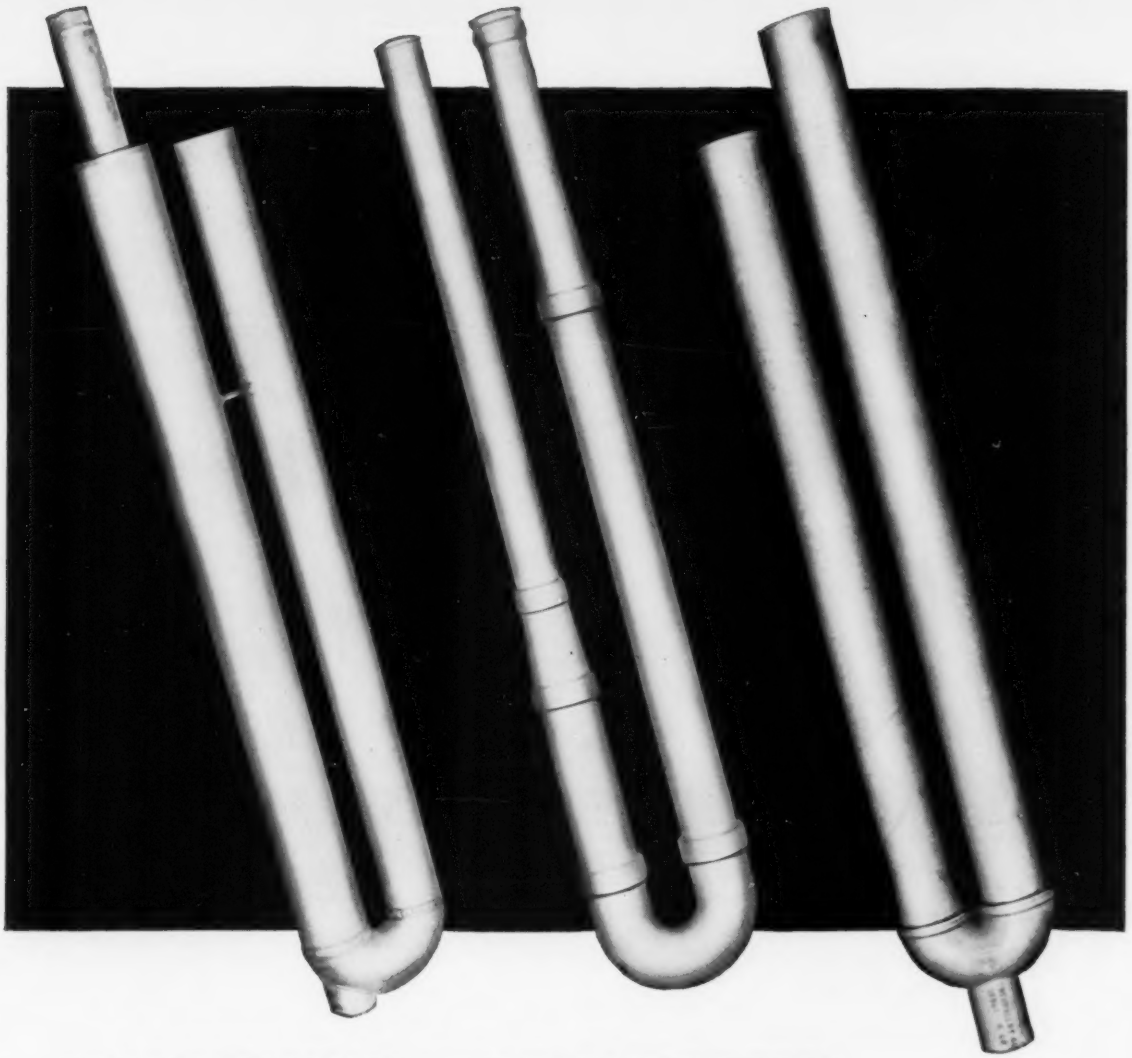
Interrupted quenching treatment is the rapid cooling of work to a selected temperature by quenching in hot salt. The three major operations in use today are: austempering, martempering and cyclic annealing.

Austempering—provides for medium hardness combined with ductility and toughness and maximum control of distortion.

Martempering—provides high hardness equal to oil quenching with greatly reduced distortion and practically no internal stresses in the hardened piece.

Cyclic Annealing—produces a soft and easily controlled structure with a very short time cycle.

(*Continued on page* 28)



GET MORE HOURS OF SERVICE FROM

Thermalloy* radiant tubes

Make Electro-Alloys your source if you want radiant tube assemblies that will give more life and reduce maintenance costs.

All components are produced in suitable analyses under close metallurgical supervision, and with X-ray control. The straight tube sections are centrifugally cast in such a way that wall thickness is uniform throughout; i. e., inside diameter and outside diameter are concentric, and thickness is the same the full length of the tube. All finished assemblies are pressure-tested before shipment to insure freedom from leakage. As a result, you are assured of radiant tube assemblies that last longer without cracking, warping or sagging.

Whatever your needs in radiant tube assemblies or other heat-treating equipment—you'll get more operating economy from high heat-resistant Thermalloy castings. Let us know your requirements. Call your nearest Electro-Alloys engineer or write Electro-Alloys Division, 5003 Taylor Street, Elyria, Ohio.

AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION

ELYRIA, OHIO

*Reg. U. S. Pat. Off

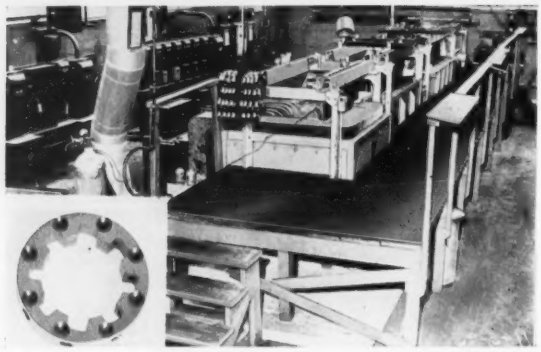


Fig. 6—Austempering dynaflow cams (see inset) has resulted in savings due to reduction in dimensional changes. Each fixture holding 130 cams passes through austenitizing, isothermal quench and draw baths in one hour.

Austempering, illustrated by Fig. 6, is used on relatively light sections, ¼" or less, where hardness requirements fall between Rc 35 to 50 and where toughness, or ability to bend without breaking after hardening, is a requirement. Such parts as shoe shanks, typewriter parts, sewing machine parts, automotive bumpers, springs, clutch plates and other automotive parts, open ended and socket wrenches, pliers, etc., are commonly austempered. The steel is generally carbon steel type of SAE 1000 series, although alloys are occasionally used.

In martempering, as shown in Fig. 7, alloy steel or carburized steel is the rule and heavier sections can be treated successfully. Ball bearing races are a popular application. SAE 52100 is generally used and sections as great as 1¼" are being martempered commercially today. Likewise, many types of tools, gauges, accurately finished parts, where high stress or high hardness requirements are to be met, are martempered. The greatest advantage of the process lies in the control of distortion. Final grinding of heat treated parts is an expensive operation and the saving in even a moderate reduction of the finish grind can easily be greater than the total cost of heat treating.

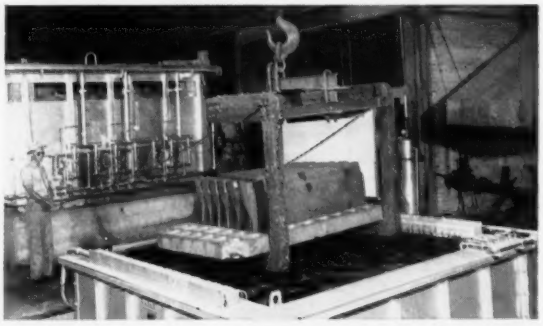


Fig. 7—Nine tons of cast steel crusher jaw plates are lowered into quench furnace, the final step in martempering operation.

One of the most promising fields for martempering is the one which combines it with the carburizing process. For instance, an enormous number of gears are carburized and hardened which must then be finished by grinding or lapping to extremely close tolerances. A very substantial saving can be secured by a martempering quench directly following the carburizing bath.

By applying the teachings of the "S" curve, steel can be annealed by transformation at a constant sub-critical temperature in a comparatively short time. This process is called cyclic annealing. In the cyclic annealing process, the steel is heated first to the austenitizing temperature, then quenched in another bath operating in the range of 1100 to 1300°F. The temperature should then remain constant for the time indicated by the "S" curve to complete transformation to the desired soft structure. Then the work can be quenched in the air or water as rapidly as possible. Depending on the analysis of steel, the total cyclic annealing operation requires only from 30 minutes to a few hours. The operation is quite different from conventional furnace annealing which requires extremely slow cooling rates and cycles ranging from 5 to 24 hours.

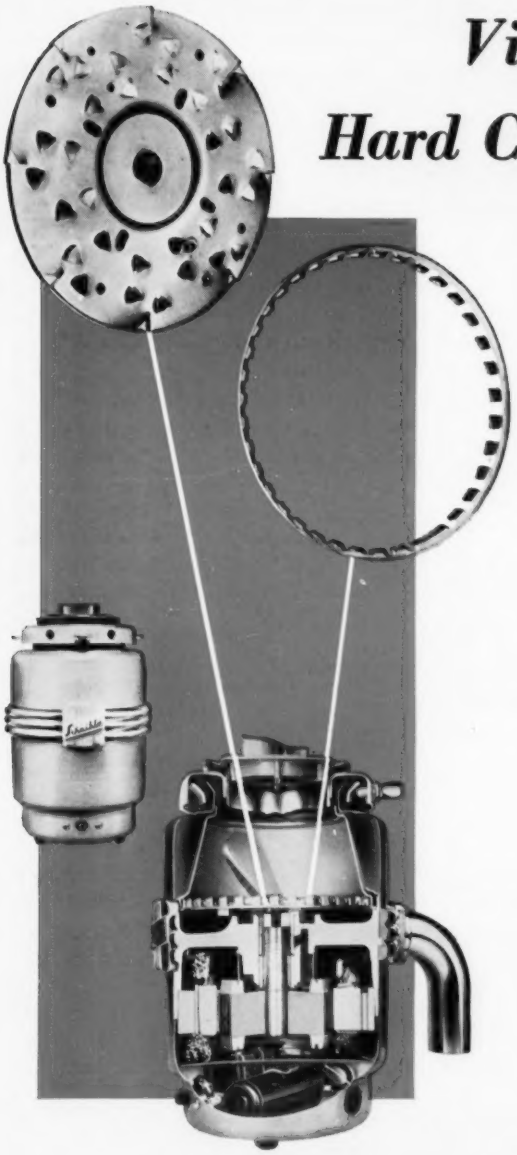
A prominent automobile manufacturer has already adopted the cyclic annealing process in a rather novel manner by utilizing the residual heat

(*Continued on page* 30)

SPECIALISTS at Your SERVICE...
WITH THE ONLY ORGANIZATION EXCLUSIVELY DEVOTED TO ROLLED HEAT-RESISTANT ALLOYS
SHEETS
FLATS
PLATES
ROUNDS
SQUARES
HEXAGONS
Finest Quality Metals... The Result of RA Specialized Experience... Unsurpassed By Any Other Organization
Not One Heat-Resisting Alloy...But All Necessary Analyses Available
PIPE
WIRE BY COIL
NUTS
WELDING ROD
ROLLED RA ALLOYS
CARRIED IN
TYPE 330 . . 35 Ni–15 Cr–1¼ Si
TYPE 309 . . . . . 25 Cr–12 Ni
TYPE 310 . . . . . 25 Cr–20 Ni
TYPE 430 . . . . . 17 Cr
TYPE 446 . . . . . 27 Cr
ROLLED ALLOYS, INC. RA
Heat and Corrosion Resistant Alloy Specialists
4815 BELLEVUE AVENUE, DETROIT 7, MICHIGAN • TEL. WALNUT 1-4462

The Schaible Story:

Vital Grinder Parts Hard Cased in Park-Kase 5-C



The new grinding principle of the Schaible Food-Waste Disposer is shown here. Particle discharge size is positively controlled by reduction grating through horizontal milling action, impingement cutting and clipping. The snag-toothed cutter and the clip ring used in this process require hardness and toughness. Park-Kase 5-C gives these tools the necessary hard case for years of efficient, dependable service.

Fifth in a series of advertisements describing Park processes on the job

Maximum Hardness at LESS COST for Schaible Cutter Disc and Clip Ring!

At the Schaible Company the grinding elements used in the production of the Schaible Food-Waste Disposer are precision hard cased with water soluble Park-Kase 5-C. Result: a higher hardness which means longer life and greater efficiency for these fast-action grinding teeth . . . *in less time and at less cost.* Here's why:

The rapid and uniform case depth of Park-Kase 5-C liquid carburizer means fast, reproducible cases which can be held to close limits for accurate, dependable work at temperatures up to 1700°F. Park-Kase 5-C produces eutectoid carbon cases which contain enough nitrogen to be file hard after oil quenching. High penetration rates and ease of cleaning are combined for ideal carburizing conditions. Inexpensive, simple, and trouble-free . . . Park-Kase 5-C lowers production costs.

- Lightness of Original Charge and Reduction of Salt Drag-out Keeps Costs Down.
- Does Not Foam While Operating.
- Water Solubility Means Time Saved on Oil Quenched Work.
- Needs No Special Complicated Mixing Procedures.

Complete details of the Park-Kase 5-C Carburizing process covering all phases of its operations are described in a technical bulletin available by mailing the attached coupon.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

Park

PARK CHEMICAL CO.

8076 Military Avenue • Detroit 4, Michigan

Send Free Bulletin Describing Park-Kase 5-C

Name_____ Position_____

Company_____

Address_____

City_____ State_____

as the forging comes from the press or hammer. The hot forgings, above the upper critical temperature, are quenched in an agitated salt bath operating at the sub-critical temperature of the particular steel—1150 to 1250° F. with SAE 8620 steel forgings, transformation to the desired pearlitic structure is secured in approximately 45 minutes. The forgings are then flash quenched in water which removes all of the salt and most of the scale.

Annealing

Annealing by means of a salt bath furnace is of limited application. For example, where a full anneal is required to refine the grain of the steel, a slow cool from above the upper critical temperature is required. It is difficult to do this in a salt bath because of the high heat storage capacity of the bath. Practically all of the installations in use are, therefore, process anneals of low, medium and high carbon wire and rod. This is an operation generally carried out below the critical point of steel, in the range of 1250° F. for relieving cold working stresses. The time cycle is short—less than one hour—and the work can then be cooled rapidly in air or water. The surface of the finished work is clean.

Salt bath furnaces have also been very successfully applied to the annealing of stainless steel products and of nickel chrome alloys. The temperature used in this case is from 1550 to 2100°F., and the time cycle approximately 30 minutes. The work is quenched directly in water following removal from the furnace. A vertain amount of tarnish is produced on the surface but it is easily removed by a short acid dip.

Solution Heat Treatment

Salt bath furnaces are widely used for solution heat treating non-ferrous alloys principally of aluminum and copper. The complete surface protection, the high rate of heating and the accurate temperature control are the major advantages offered. A typical installation is shown in Fig. 8. It is not necessary to unload and quench an entire batch at one time. Individual pieces are readily handled and the more rapid and efficient quenching which this permits is a valuable asset. Annealing of aluminum to relieve cold working stresses, particularly where a selective anneal is desired is also an excellent application.

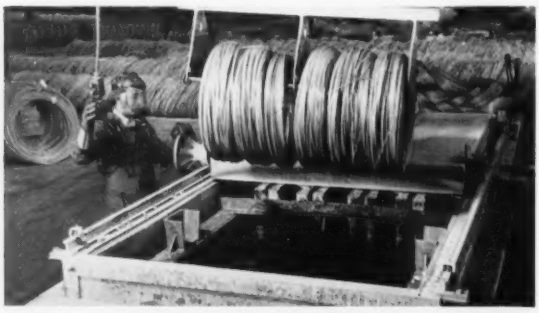


Fig. 8—Aluminum alloy wire (61-S) about to be solution heat treated in an Ajax furnace.

Descaling and Desanding

Descaling and desanding are two recent applications for salt bath furnaces developed during the war. Both use a sodium hydroxide bath with suitable chemical additions. Descaling modifies the scale so that it can be removed by acid in a matter of minutes with a metal loss that is far less than that secured when using older descaling processes.

Desanding is similar to descaling except that silicon dioxide instead of a metallic oxide is removed. Desanding is used on castings for refrigerator compressors, fuel pumps, hydraulic transmission castings, bearing caps, etc. where it is essential that all traces of sand be removed. Generally speaking, the same equipment can be used for both applications and the results are similar. Operating temperature varies between 700 to 950° F. and caustic soda is the principal salt used.

Brazing

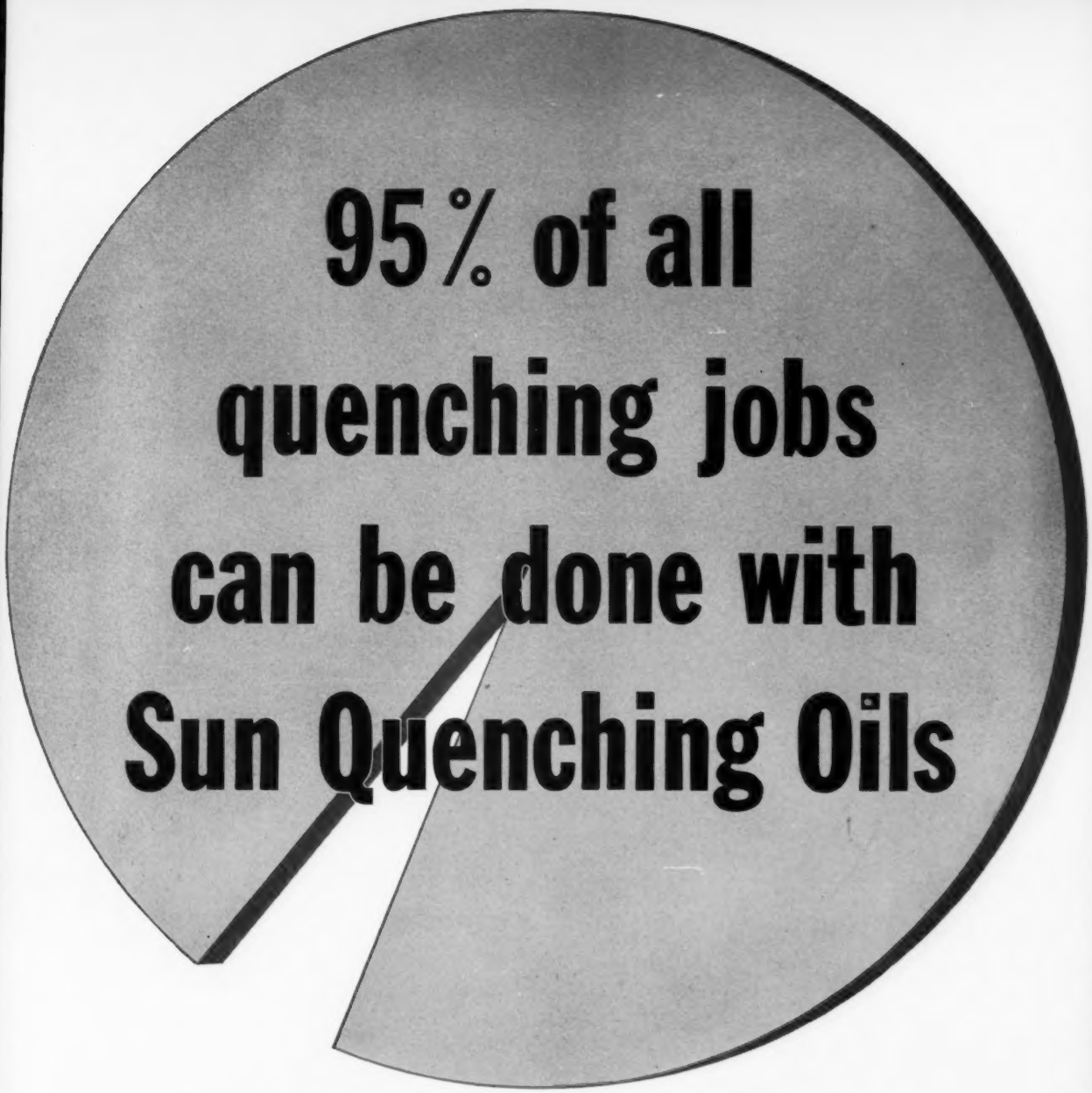
Salt bath brazing is a limited application, but where it applies, a very attractive one. All types of brazing materials can be used such as silver solders, brasses, phosphorous copper alloys and copper.

Generally speaking, the salt bath furnace will find its field of application where it is desired to braze joints differentially at one end of a complete assembly without heating the balance of the assembly. Such products, for instance, as heat exchange units, where a large number of return bends must be brazed to the tubes, make an ideal application. Only that portion of the assembly to be brazed is immersed. In some installations, the total brazing cycle does not exceed 90 seconds.

Salt bath furnaces are used extensively in the brazing of aluminum assemblies. The salt used is actually of the same composition as the flux normally used in torch or furnace brazing and serves the dual purpose of heating the assembly, fusing the bonding material and at the same time fluxing the surfaces of the aluminum to provide a good braze.

An interesting modification of salt bath brazing combines the carburizing and the brazing operation in one step. The joining of various sub-assemblies in the manufacturing of automotive parts is a good example of this process. These assemblies,

(*Continued on page* 32)



. . . AT MUCH LOWER COST

For 95% of your quenching jobs, you don't have to use expensive compounded oils. Sun's low-cost quenching oils will give the same uniform results, assure fast and thorough quenching, help increase production and lower maintenance. The booklet "Sun Quenching Oils" tells the complete story. For your copy, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. MR-7.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

SALT BATH FURNACES (cont'd)

when completed should be carburized and quenched. A carburizing bath is excellent for brazing, and by selecting a bonding material melting at the correct temperature, it is entirely practical to secure the necessary carburizing in its normal time cycle while at the same time providing for an excellent braze on several parts. The assembly upon being withdrawn from the carburizing furnace can be quenched in the normal manner to develop the required hardness.

Heating for Forging

The obvious advantage of heating a metal very rapidly in salt with the total absence of scale or decarburization has created a great deal of interest in the use of salt furnaces for heating for forging. In this process the salt acts as a lubricant which appreciably increases die life. In fact, reports from the field indicate the doubling of die life in upset forging machines. This heating process also makes it possible to extrude alloy steel parts including stainless steel. ■ ■ ■

As Near As Your Phone

Your STANWOOD Sales Representative

for Containers — Fixtures — Trays

Avoid the costly mistake of using the wrong containers, baskets, trays or fixtures—call the Stanwood man in your locality. He'll see you promptly with the cost cutting facts—whatever your heat treating or parts handling job.

CALIF., Hollywood 28—Lloyd J. Bohan, 1680 N. Vine Street, Phone Granite 8367.

IND., Indianapolis 1—William McAtee, 626 N. DeQuincy Street, Phone Irvington 1483.

MASS., Brookline 46—Harry I. Dixon, Metallurgical Products Co., 1199 Beacon Street, Phone Longwood 6-8093.

MICH., Detroit 21—Carl H. Schmidt 2405 W. McNichols Rd., Phone University 1-4200.

MINN., St. Paul 4—A. A. Gustafson, 2580 University Avenue, Phone Midway 7630.

N. Y. City 1—R. B. Steele, 254 W. 31st Street, Phone Longacre 5-5296.

N. Y., Syracuse 2—J. R. Stewart, 300 University Bldg., Phone 2-9686.

OHIO, Cleveland 2—Charles Plant Jr., Alloy Sales & Service, 8905 Lake Ave., Phone Melrose 1-1018.

OHIO, Dayton—Fred. L. Stork, 808 Wellmeier Ave., Phone Madison 1595.

PENNA., Pittsburgh 19—R. A. Schmidt, 404 Frick Bldg., Phone Court 1-2310.

TENN., Memphis 7—Eugene S. Craig, 1101 Poplar Avenue, Phone 2-5777.

TEXAS, Houston 4—M. K. Griggs Co., 2801 San Jacinto, Phone Atwood 2261.

WIS., Milwaukee 2—Robert M. Onan, Colby-Abbott Bldg., 759 N. Milwaukee Street, Phone Broadway 2-5285.

Stanwood Corporation

4825 W. CORTLAND ST. Chicago 39, Ill.

Heat Treating ABSTRACTS

Atmosphere Control Through Dew Point

The Lindberg Engineering Company, Chicago, Ill., has completed, under the direction of the author, a five year study of the equilibrium relationships between the dew point of endothermic atmospheres and a wide range of steel compositions. An exhaustive series of tests was made to develop equilibrium relationships over the range of 1400 to 2100° F. for carbon contents of .30 to 1.10% in straight carbon steels and a wide variety of production and tool steels.

The tests run to develop the curves published by the author were made in a Lindberg "L" type tool room furnace using "Hyen" endothermic atmosphere. Thus it is felt that the curves are directly applicable to production work and can be used for atmospheres from other manufacturers' endothermic generators, provided the gas is completely reacted. It is cautioned, however, that the curves are not infallible although they have been checked in production operations during the past year or more.

Following are precautions suggested in using the curves and other hints on controlling atmospheres:

Sampling—During the tests all dew point measurements were made on samples in the furnace since variations between the dew point of the gas entering the furnace and gas in the furnace were found. An Inconel sampling tube is preferred since ordinary or low alloy steel will oxidize and thus affect readings.

Instrument—It is recommended that an accurate instrument be used to measure dew point since "guess" measurements can be off 10 to 20° F.

Generator—The published curves should be applicable to all completely reacted endothermic gases. Methane should not exceed 1.5% at dew points down to 10° F. and CO_2 should be zero. If methane is present in greater amounts, or if CO_2 is present, the gas is not completely reacted and the equilibrium curves will not apply.

Gas Cracked—Natural gas is preferred but propane or city gas can be used. Unsaturated hydrocarbon impurities in propane should not exceed 5% and above 10% they will cause sooting in the generator when operated at low dew points. City or manufactured gas varies in analysis and is hard to control, thus propane is recommended second to natural gas as dew point is critical.

Enrichment—This creates a higher carbon potential but the degree of shift in the equilibrium

(*Continued on page* 39)

measuring up

...and REX is the standard by which all high speed steels are compared

An older brother sometimes makes a handy yardstick for measuring junior's growth. And when it comes to tool steels, REX® High Speed Steel is — and has been for over 50 years — the standard of comparison.

There's no mystery to REX High Speed Steel. Its quality has been time-tested in thousands of shops. And after all, it's performance — not claims — that really counts. Make your *own* comparison test. Put REX High Speed Steel to work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You won't find another high speed steel that surpasses REX.

Remember, too, that even though it is widely distributed and used, REX High Speed Steel is made *only* by Crucible. So for tops in high speed steel performance, be sure you order the Crucible REX brand.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

data tabulated for cost accounting purposes. Tabulating can be done manually or by mechanical tabulating equipment. In fact, the entire payroll procedure can be handled mechanically. There are service bureaus in many cities providing such service to companies who do not have sufficient volume to warrant having this equipment in their own offices.

If there is a substantial range in rates paid, and if the higher paid employees are customarily used in certain particular departments, the actual wages of the various employees should be charged to the respective departments in which they work. On the other hand, if rate ranges do not follow departmental lines, then the payroll distribution may be somewhat simplified as follows:

(1) Total the wages of all productive employees. This will be total Direct Labor.

(2) Tabulate the work cards and compute the percentage of total hours for each department as compared to total hours for all departments. The total Direct Labor will be distributed by these percentages. This latter method is particularly well suited to plants which have a high ratio of floating man hours. By this we mean, men who work in one department one day, and another department the next day.

TREATING MATERIALS:

These are the materials and supplies used in the various processing operations in a heat treating plant. There are about 40 to 50 different items including such things as the various types of salt, cyanide, ammonia, carburizing compounds, steel grit and sand for blasting machines, quenching oils, etc. We consider these items as a direct expense because it is possible to charge the various departments with the amounts actually consumed.

The procedures involved would not seem to require explanation here, except possibly to comment that a few of the materials are commonly used by several departments and simple schedules can be set up to allocate such items. For example, quenching oils may be allocated on the basis of relative quench tank sizes. Storekeepers labor costs, if any, may be included in the cost of materials. Treating Fixtures are charged to the departments for which they are made or purchased. Special fixtures would be charged to the particular jobs or orders on which they are to be used, but not included in the Departmental Cost Summary.

ELECTRIC POWER:

The most accurate method of measuring power or fuel consumption is to have meters on each piece of equipment. At first glance this might seem ridiculous, but since heat treating plants are such large consumers and in view of the fact that a meter might cost less than 2% of the furnace cost, the idea does not seem completely impractical. However, there are other methods of arriving at reasonably accurate costs.

A schedule can be set up for applying the power bill to the equipment. Use a columnar sheet and list each piece of electrical equipment in the description column. Arrange the listings by departments. Enter the KW rating of each unit in the first column. Enter the operating hours in the second column. Multiply the KW rating of each unit by the hours it was operated and the result will be the rated KWH for the period, which figures will be entered in the third column. (The operating hours used in this schedule come from Idle Equipment Reports which will be described in the next paper.) Run a total on the rated KWH column and prorate the power bill to the equipment on the basis of average cost per rated KWH. These final figures will be entered in the fourth column and subtotals run for the various departments.

FUEL (Gas & Oil):

Set up a schedule listing each piece of equipment in the description column. (If there are both gas-fired and oil-fired furnaces in the plant, a separate schedule must be used for each.) In the first column enter the manufacturers' maximum BTU input rating of each unit. Enter the operating hours in Column 2, multiply Column 1 by Column 2, and the result will be the BTU rating for each unit for the period. Convert to therms, which will be entered in Column 4. Run total of rated therms column and prorate the gas (or oil) bill to the equipment on the basis of average cost per rated therm.

It is recognized that in different types of furnaces there are variations in the relationship of BTU ratings and heating efficiency. It is possible to compensate for these variations by use of heating efficiency factors. The rated KWH and rated therms would be multiplied by the applicable factors before prorating the power and gas bills. We will not attempt to suggest what factors should be used, because of the many types of furnaces in use, but most utility companies are glad to assist in this respect, free of charge.

WATER:

An estimated distribution of the water bill is sufficient as it usually is a relatively minor expense.

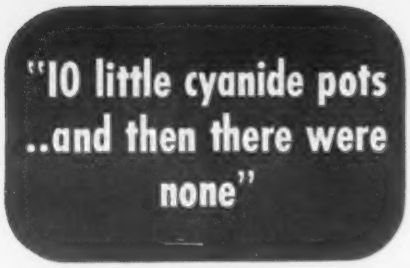
Distribution Accounts

This brings us to the Distribution Accounts. The contents of these accounts need not be reviewed as they were covered in detail by the previous paper.

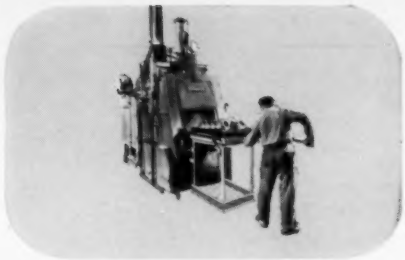
BUILDING OCCUPANCY:

The total of this account is allocated on a square

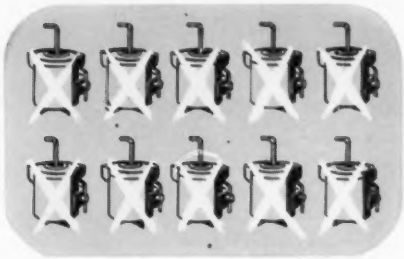
(*Continued on page* 36)



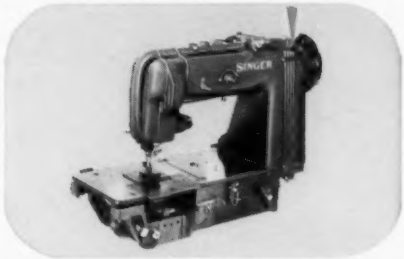
1. Featuring Singer Sewing Machines and Lindberg Carbo-nitriding Furnaces.



2. Singer Manufacturing Co. bought a new Lindberg Carbo-nitriding furnace.



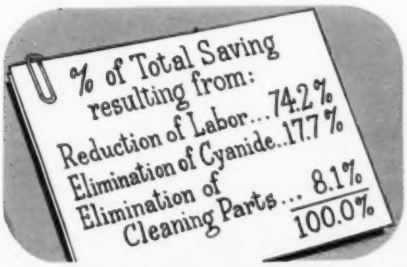
3. It replaced 10 liquid cyanide furnaces.



4. The new furnace heat treats parts for "industrial sewing machines"... used for stitching canvas, mattresses, overalls, etc.

5. In 12 months, the new Lindberg Carbo-nitriding furnace paid for itself in savings.

6. Mr. Lloyd R. Raymond, Supt. of heat treating at Bridgeport plant of Singer.



7. . . . submitted this report to his top management.

8. . . . with this requisition for a second Lindberg Carbo-nitriding furnace (to double production of carbonitrided parts).

footage basis. In the smaller plants, where the ratio of nonproductive area to productive area is low, the entire Building Occupancy account might be allocated only to the productive units. In larger plants final unit costs will be more accurate if the Building Occupancy account is allocated to the respective indirect departments as well as the productive departments. In either case, the suggested procedure is to measure the floor space occupied by each department and/or productive unit including aisle space and material storage area assignable to each. Add all of the assigned space and calculate the percentage of the total that is used by each. The resulting percentage figures will be the area factors that are to be used in allocating the Building Occupancy account.

The decision to allocate part of this cost to indirect departments should depend upon the relative effect upon final unit costs. This effect will increase as the ratio of indirect areas to productive areas increases and also as the ratio of Building Occupancy Expense to total Factory Expense increases.

If circumstances warrant allocation to both direct and indirect departments, the procedure is as follows: Charge Quality Control with the portion applicable to metallurgical laboratory, inspection department, and shop offices used by shop supervisors; Equipment Maintenance with maintenance department area; Material Handling with shipping and receiving, and order department areas; General and Administrative with general office areas; and allocate the balance to productive units.

QUALITY CONTROL:

We recommend that this account be allocated on the direct labor man hour basis. Each productive department would bear a share of this account in the same ratio that its direct labor man hours bears to total direct labor man hours.

The Committee feels that, as a general rule, quality control is synonymous with the control of human error. We are well aware that cases may be cited which are contrary to this concept. Two examples: the requirement of 100% inspection on a job may be completely unrelated to the productive man hours used in processing it; the metallurgical engineering involved in setting up a job may have no relationship to the direct labor man hours required to produce it. Other examples could be cited, but we believe a fair appraisal shows that a predominant portion of these expenses follow the pattern of direct labor. The final article, "Application of Unit Costs," will cover the treatment of jobs calling for exceptional quality control.

EQUIPMENT MAINTENANCE:

Although carried as a Distribution Account on the Summary of Factory Expense, this account is made up of components which, if allocated by a single method, would result in overstatement of maintenance cost on some equipment and understatement of such cost on other equipment.

The maintenance labor costs can be charged to appropriate productive units by use of maintenance work cards. This can be the same type of card suggested for use by direct labor employees. It should show the specific unit that the maintenance man worked on, and the time involved. You will find that most maintenance labor can be tied down to specific furnaces or machines. However, some of it will involve accessory equipment such as compressors, blowers, generators, etc. This part must be allocated to the productive equipment served. Tabulation of the cards will produce data for posting to a maintenance summary sheet.

Replacement parts and materials will also be entered on the maintenance summary. Those items used on specific units will be charged directly to such equipment. Items which are more general in nature must be allocated. Your maintenance foremen or plant engineer is the best qualified person you can find to establish the basis for allocating those items which can not be charged to definite production units.

The maintenance summary must agree in total with the general ledger controls as represented by the Equipment Maintenance account on the Summary of Factory Expenses.

MATERIAL HANDLING:

This account is comprised of the costs of in-plant handling of materials that are processed. It includes labor costs of dockmen, receiving and shipping clerks, order writers, factory truck operators, and the cost of shop orders, other printed forms, wrapping and packaging materials, skids, tote boxes, and related expenses.

We realize that these costs may be incurred in an entirely different manner in one plant than in another. In some of the smaller plants, most material handling is taken care of by direct labor, and order writing and other paper work is done in the general office. In such cases, it would not be practical to set up a Distribution Account for material handling expenses. The handling is absorbed by Direct Labor Costs and the paper work by General and Administrative Costs.

In larger plants, indirect operations and jobs are generally segregated from the direct or productive functions. The primary purpose of this is to realize maximum productive efficiency, but it also permits a more accurate appraisal of the various kinds of operating costs. If a plant falls in this category, increased accuracy of unit costs may be attained by allocating material handling expense to the various productive departments by a formula which will reflect the variable characteristics of this expense. A study of types of work processed, size and num-

(*Continued on page* 38)

GE Move

The General Electric Company will begin construction this year of a new $5,000,000 plant at Shelbyville, Ind., to manufacture industrial furnaces, induction heating equipment, and heating devices.

The announcement was made recently by E. W. Cunningham, general manager of the company's Industrial Heating Department, which will headquarter at Shelbyville.

When completed in 1955, the new plant will accommodate manufacturing operations now located at Schenectady and Pittsfield, Mass. It will be located on a 50-acre site, two miles east of the downtown area of Shelbyville.

The Industrial Heating Department is part of the G-E Measurements and Industrial Products Division, headed by vice-president Harold E. Strang.

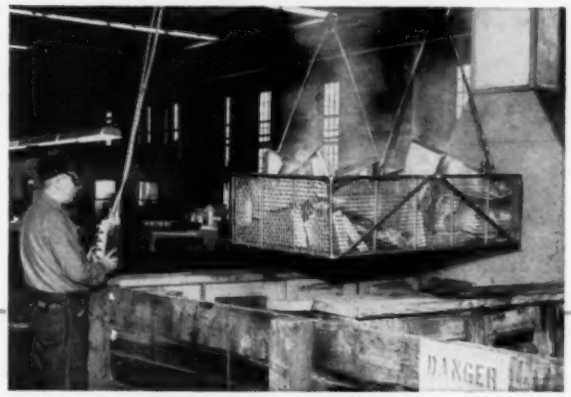
Annealing Installation

The Warren, Ohio, plant of the Thomas Strip Division of Pittsburgh Steel Company has placed in operation a new annealing furnace and two additional furnace bases in a new 40 x 60 foot addition to the main plant building.

The new Lee Wilson gas-fired radiant tube type circular furnace, which can be moved from base to base, is one of a battery of three modern portable furnaces. The three furnaces have a total of seven 88-inch diameter bases. The newest installation adds 1,000 tons a month to the plant's annealing capacity and represents a $135,000 investment.

Each of the three large circular, portable furnace bases will hold three or four stacks of coils piled to a height of about 94 inches. The average charge is 35 to 40 tons.

ROLOCK
FABRICATED ALLOYS
BASKET SERVICE THAT'S HARD TO BEAT
AT WILLYS MOTORS, INC. ALUMINUM FORGE DIVISION



Shown in action is one of 24 similar stainless steel etch baskets designed and fabricated by Rolock Incorporated. Dimensions are 6' x 3' x 16½"; load is 500 lbs. of aluminum forgings . . . thru the following 6-cycle operations:

A. Acid pickle, 10% sulphuric acid, 3% chromic acid solution at 160° F.
B. Cold water rinse.
C. Etch in 10%-15% caustic solution at 160°-180° F.
D. Cold water rinse.
E. Bright dip in 10% sulphuric acid, 3% chromic acid solution at 160° F.
F. Hot water rinse.

EACH BASKET has been subjected to an average of 125 cycles per month for more than SIX YEARS . . . and they're still going strong . . . after a total of about 10,000 cycles. THAT IS SERVICE!

This Case History is another demonstration of the value of Rolock engineered-to-the-job, fabricated-welded design and construction of containers for handling metal parts.

Extended service life reduces costs materially, improves the work, cuts time. Rolock design and construction raises the ratio of load to basket weight, thus again reducing costs.

Rolock engineers welcome your inquiries for baskets, trays, racks, crates, fixtures, retorts, muffles, vessels, kettles, etc., for heat and corrosion resistant applications.

Send your tough problems to us for solution. We welcome the challenge.

SALES AND SERVICE REPRESENTATIVES FROM COAST TO COAST

ROLOCK INC. • 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

GRLS4B

Service-Life:

"1,560 hrs!"

(1,272 pay hrs. and 288 idling hrs.)

Ad-Therm (Non Alloy Steel) Neutral Salt Pot still serviceable after 1,560 hrs. (removal due to slow recovery, not a "leaker").

★ Ad-Therm metallurgy solves your salt pot problems! Metal treaters are re-ordering Ad-Therm Salt Pots because they *out-perform all others,* and cost *less.* They're fabricated (not cast) of a patented, special non alloy steel which, for the first time, offers the *ideal hi-heat and endurance characteristics* you've been looking for. Here is the right combination of *high thermal conductivity for efficient heating,* and *heavier wall thicknesses for longer life.* All standard sizes available. Engineered and manufactured by Advance Thermal Equipment Co., Cleveland, O.

SEND FOR COMPLETE DETAILS AND PRICE LIST
Sole Distributor

PARK CHEMICAL COMPANY

8074 Military Ave. **Detroit 4, Mich.**

ber of orders handled, methods of handling, etc., will provide the basic information for setting up an allocation method.

The Committee suggests that a practical method of allocation may be based on relative rated production capacities of the different furnaces and machines in terms of pounds. Two modifications of the rated capacities are necessary in the development of the formula. (1) Multiply rated capacities by respective equipment hours operated. (2) Multiply results of modification number 1 by predetermined weighing factors to adjust for variables in comparative cost of handling different classes of work. The Material Handling account is then allocated to the productive departments and individual units of equipment on the basis of the modified rated capacities.

FIXED CHARGES:

This account consists of depreciation, insurance and personal property taxes applicable to the productive equipment. Proration of the total of these expenses by either relative appraised values or insurable values will produce satisfactory results. The portion applied to accessory equipment; compressors, blowers, generators, etc., should be reallocated to the productive equipment served.

This completes the allocation and/or application of factory expenses to the productive departments. The results are recorded on the Departmental Cost Summary. The costs of Outside Trucking and Outside Work are not included because these items have little or no bearing on factory costs. A suggestion as to the handling of these costs will be offered in the next article. ■ ■ ■

curves is not reported. Care is recommended in burning off any precipitated carbon in the furnace before attempting to establish precise dew point control at higher temperatures.

Surface Condition of the Work—Mill and forging scale can cause difficulty through reduction of the oxide leaving a spongy barrier of iron on the surface which hampers carbon diffusion. Also, iron oxide may act as a catalyst breaking CO down to CO_2 and soot which in turn may create a higher carbon potential around the work and carburize it.

Degree of Control—For most work, dew point controlled within ±5° F. is satisfactory. However, the need for accuracy increases as temperature or soaking time increases.

(Abstracted from "Dew Point—A Means of Measuring the Carbon Potential of Prepared Atmospheres" by N. K. Koebel, *Metal Progress*, February, 1954.)

Heat Treating Hot Work Tools

Carburization or decarburization is often encountered when heat treating hot work steels even when salt baths or atmosphere controlled equipment is used. Main cause of this is the lower (.35 to .60% carbon content of hot work steels bringing on carburization from atmospheric adjuster for higher carbon contents. Packing materials such as cast iron chips, spent carburizing compounds and wood charcoal will also have a carburizing effect on these steels.

Coatings such as borax and water glass have been used to avoid decarburizing in oxidizing atmospheres but are not completely effective and are difficult to remove.

Due to the wide-spread use of copper plating as a "stop-off", tests were conducted to develop techniques which would expand its use to the prevention of decarburization as well as carburization. Copper plate will not prevent decarburization in oxidizing atmospheres at high temperature but if a protective atmosphere is used, complete protection of the work is possible at temperatures up to 1950° F. Beyond this point the copper will melt and damage tool surfaces.

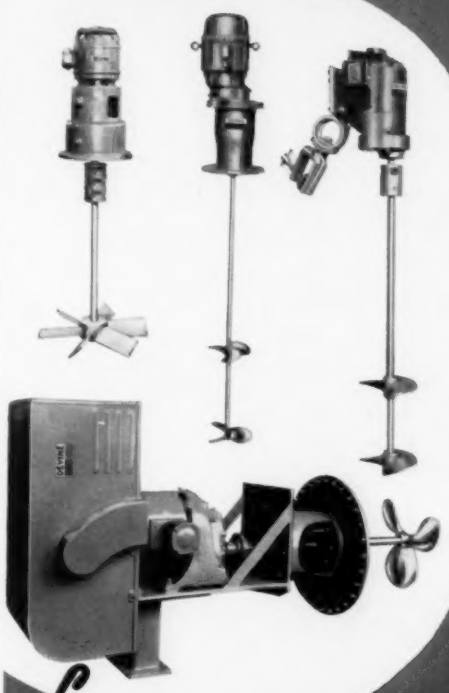
A series of tests was made using bars of Cr-Mo-W hot work steel (SAE type H12) with copper coatings .003" and .006" thick. These and unprotected samples were heat treated by oil quenching from 1850° F. followed by tempering at 1200° F. for two hours. Cast iron chips, wood charcoal, carburizing compound and open atmosphere were used in the tests.

Test results showed the .003" and .006" copper coatings to be completely satisfactory when protected by one of the packing compounds. Removing the coatings is a simple matter since they may be easily peeled off the tool after hardening.

(Abstracted from "Protection of Hot Work Tools in Heat Treatment" by J. Y. Riedel, *Metal Progress*, March, 1954.)

Devine

Agitators



for

UNIFORM QUENCHING TEMPERATURES

- Provide proper circulation of quenching liquid.
- Help equalize quenching strains.
- Compact. Self-contained. No piping required.
- Unusually sturdy. Built for plenty of use.
- Easy to install. Easy to detach. Easy to maintain.

Devine Engineers will be glad to recommend a type and size to fit your tank.

J. P. DEVINE MFG. CO.
A. M. Cox, President
49th Street and A.V.R.R. Pittsburgh 1, Pa.

LETTERS TO THE EDITOR

Dear Editor:

I have noticed with interest the article on "Heat Treatment in the Production of Magnets" in your March-April issue of Metal Treating, and was quite surprised to see where the General Electric Company claim the roller hearth furnace they have at their Edmor, Michigan plant is the only roller hearth furnace in the magnet manufacturing field. The reason we were surprised at this statement is the fact that we have had a radiant tube, gas fired roller hearth furnace handling the same type of work at a plant in Indiana. In fact, a picture of this furnace was shown in your September-October 1953 issue under the article "Furnace Symposium No. 4, Roller Hearth Furnaces." This is shown in Figure 3, page 3, of that issue.

I thought you might be interested in this fact, and also that this furnace has been in operation since the latter part of 1946.

C. O. KNIERIM
Engr., Furnace Div.
The Gas Machinery Company
Cleveland, Ohio

Ed.'s reply below:

Dear Mr. Knierim:

Thank you for your letter of April 20th calling our attention to the roller-hearth furnace mentioned in the Furnace Symposium article in our September-October 1953 issue. We, of course, had no way of knowing that this furnace was used for magnet manufacturing for neither the article nor caption so states. G.E. was apparently under the impression that their furnace was the only one used in the magnet manufacturing field.

I am sending copies of this correspondence to the source of the G.E. article so that he will be properly informed of the fact that your furnace is functioning in the same field.

Thank you again for calling this to our attention.

METAL TREATING
Editor

Gentlemen:

Have just finished reading the January-February issue of Metal Treating, and found it very interesting.

I am seeking information. Will you kindly advise me where to get 16-MM sound film on the heat treating of steels, to be used in an educational manner in our plant?

Your help will be appreciated.

WM. H. KAUTZ
Foreman, Heat Treating Dept.
Oerlikon Tool and Arms Corp. of America
Asheville, N.C.

Ed.—Information on three films available from various concerns was sent.

Dear Sir:

I have recently seen the "Metal Treating" publication for the first time. Will you please advise me about the yearly subscription rates.

I am an engineer at the Du Pont Wilmington Shops and the publication would prove of value to me.

QUENTIN C. JURGENSEN
Newark, Delaware

Ed.—Hope future issues will be helpful to you.

Gentlemen:

I have found your magazine both interesting and helpful in answering problems which come to my attention in my work in the inspection and sales departments of the Drever Company, 220 W. Cambria Street, Phila. 33, Pa.

If it is at all possible, will you kindly place my name on your mailing list so that I will receive each issue as it comes off the press.

JAMES BANNON
Heat Treating
Drever Company
Philadelphia, Pa.

Ed.—Will do.

Gentlemen:

In your January-February 1954 issue of "Metal Treating," there is noted three special treatments for critical jobs. These are "Silver Finish Hardening," "Nusite Hardening," and "Ad-Life" hardening. I am familiar with the "Nusite" process, however, the other two processes are foreign to me.

Any information that you might supply concerning these two methods of heat treating would be greatly appreciated.

C. L. GAUNT
Process Dept.
Delco-Remy Division
General Motors Corp.
Anderson, Indiana

Ed.—Referred to Perfection Tool and Metal Heat Treating Company who provide these processes.

FOR SALE

Gas Fired Transformer Coil Drying and Baking Oven—Process Heating Inc., 13'6" long x 4'3" high and 4'6" wide, four compartment. Cost $7,189.

Annealing Furnace—American Gas Furnace Co. #162 Mesh Belt Conveyor Heating Machine. Entrance 20" wide x 8" high, 96" available heating length. Cost $7,200.

Vacuum Impregnating Tank—F. J. Stokes Machine Co. #56-36. Approximate I. D. 35¼", inside depth 71"; with Liquor Storage Tank #57-42, approximate I. D. 41¼" x 60" depth. Complete with Pump, Oil Clarifier and accessories. Cost $5,175.

Write: NATHAN STRAUS-DUPARQUET, INC. 33 E. 17 St., New York 3, N. Y.

Dear Sir:

During several of my recent trips around my territory at which times my visits included Syracuse Heat Treating Corp., and Commercial Heat Treating, Bridgeport I requested information as to how it might be possible to be put on your mailing list to receive your publication which to me is both interesting and informative.

Both Fred Hunter and Mike Kober suggested that I direct my inquiry to you believing that you would grant my request.

W. P. FITZ-RANDOLPH
Sales Engr.
Ipsen Industries Inc.
Hartford, Conn.

Ed.—In view of your connection with heat treating we are happy to grant the request.

LP GAS INSTALLATIONS and ANHYDROUS AMMONIA PLANTS

More than 80 Peacock Plants prove . . .
"There's No Substitute For Experience"

PEACOCK CORPORATION
Box 268, Westfield, N. J.
Westfield 2-6258

FOR SALE

Well established commercial heat treating plant in Northern California complete with new equipment for production and job work. Present staff and employees can be retained. Comparatively small cash investment required. Any reasonable plan will be given consideration.
For further details, write Box D, METAL TREATING, 271 North Avenue, New Rochelle, N. Y.

FOR SALE

COMPLETE AUSTEMPERING FURNACE suitable for small parts. Consisting of high temperature furnace, all air, gas controls, Spencer turbine blower, no pyrometer. Nichrome salt pot 12" inside dia. x 18" deep. Also low temperature furnace, eight gas burners, individual pilot lights. Tank capacity 14¾" inside x 80" long x 13" deep. Mechanized conveyor chain 110 volts, 2 thermostatic controls, exhaust-pipe system. Good condition. Photos available. Price $2,500. FOB Syracuse. B. G. Sulzle, Inc., 1001 E. Hiawatha Blvd., Syracuse, N. Y.

WHAT'S YOUR PROBLEM?

ED. NOTE: Frequently "*Metal Treating*" is asked for answers to heat treating problems of various types. These are referred to technicians, metallurgists, etc. The correspondence below is typical.

Send us your problem—we'll try to get the answer and publish it for your benefit and others.

Dear Sir:

We have a customer who is considering using Meehanite iron type GA in a hydraulic mechanism.

His immediate problem is whether or not he can copper braze two Meehanite sections together. The foundry, Atlas Foundry Co., I believe, has indicated that there may be difficulties in the structure of the part after it has been subjected to two thousand odd degrees of heat necessary to perform a copper braze. In addition, copper brazing of any casting material is always more troublesome than plain steel, largely because of the slight porosity of the cast material, which tends to absorb the copper.

What I would like to know is what, if any, recommendations your institute can make with regard to copper brazing of Meehanite, and what subsequent heat treatment could be used to restore it to its maximum tensile strength after the brazing operation.

We know, of course, that it could be silver soldered, but, in this instance, cost is a vital factor, and silver soldering, as you know, is expensive.

I would appreciate your sending a duplicate of your reply so that I could furnish it to the engineering department of the customer in question.

Thanking you in advance for your cooperation, I am

Very truly yours,

CHAS. R. WEIR
Commonwealth Industries, Inc.
Detroit 8, Mich.

Dear Mr. Weir:

I have your letter of June enclosing the blueprint of the assembly which your customer would like to copper braze. As you have pointed out, it is not reasonable to induction braze the assembly and, in order to braze at the six points indicated, it would be necessary to heat the entire assembly.

The requirement that the entire part be heated, completely eliminates the possibility of furnace brazing this piece at a temperature of 2000° F. At this temperature you would encounter distortion, graphitization of the metal and very probably, insipient melting of minor constituents.

We recommend that the assembly be brazed using a brazing material of lower melting point, thus allowing a furnace braze at a temperature up to the maximum of 1800° F. If this procedure is used, the part should be heated to the brazing temperature and held there for as short a time as possible, and then slowly cooled to approximately 1350° F. followed by an air quench.

There are various brass alloys available for brazing which require lower temperatures and I would suggest that you recommend using one of these to your customer.

The important considerations in this operation are that:

a.) The part not be held at especially high temperatures (above 1600° F.) for long periods of time.

b.) If hardening is to be eliminated, the assembly must be given a slow cool between the critical range of approximately 1350° F. to 1550° F.

I hope this information provides you with sufficient material to properly recommend a satisfactory brazing procedure.

Sincerely yours,

C. E. HERINGTON
Executive Secretary
Metal Treating Institute

METAL TREATING

EQUIPMENT and MATERIALS DIRECTORY

AGITATORS

J. P. DEVINE MANUFACTURING CO.
49th Street and A. V. R. R.
Pittsburgh 1, Pennsylvania

★ ★ ★

ALLOY POTS, FIXTURES, ETC.

ADVANCE THERMAL EQUIPMENT CO.
1468 W. 9th Street
Cleveland 13, Ohio

ECLIPSE FUEL ENGINEERING CO.
Rockford, Illinois

ELECTRO-ALLOYS DIVISION
American Brake Shoe Company
Elyria, Ohio

INTERNATIONAL NICKEL CO., INC.
67 Wall Street
New York 5, New York

MISCO FABRICATORS, INC.
1999 Guoin Street
Detroit 7, Michigan

THE PRESSED STEEL COMPANY
Wilkes-Barre, Pennsylvania

ROLLED ALLOYS, INC.
4815 Bellevue Avenue
Detroit 7, Michigan

ROLOCK INC.
1232 Kings Highway
Fairfield, Connecticut

STANWOOD CORP.
4825 W. Cortland St.
Chicago 39, Ill.

★ ★ ★

FURNACES

DEMPSEY INDUSTRIAL FURNACE CORP.
125 Main Street
Springfield 1, Mass.

DENVER FIRE CLAY COMPANY
2301 Blake Street
Denver, Colorado

DREVER COMPANY
736 E. Venango St.
Philadelphia 34, Pa.

ECLIPSE FUEL ENGINEERING CO.
Rockford, Illinois

THE GAS MACHINERY COMPANY
16110 Waterloo Road
Cleveland 10, Ohio

HEVI DUTY ELECTRIC COMPANY
Milwaukee 1, Wisconsin

LINDBERG ENGINEERING CO.
2446 W. Hubbard Street
Chicago 11, Illinois

★ ★ ★

FURNACES (Salt Bath)

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

★ ★ ★

GASES

AMMONIA DIVISION ARMOUR AND COMPANY
1355 W. 31st Street
Chicago, Illinois

NITROGEN DIVISION ALLIED CHEMICAL & DYE CORP.
40 Rector Street
New York 6, New York

★ ★ ★

GAS GENERATORS

BAKER & COMPANY, INC.
113 Astor Street
Newark 5, New Jersey

LINDBERG ENGINEERING CO.
2466 W. Hubbard Street
Chicago 11, Illinois

★ ★ ★

IMPREGNATION EQUIPMENT

J. P. DEVINE MANUFACTURING CO.
49th Street and A. V. R. R.
Pittsburgh 1, Pennsylvania

★ ★ ★

INDUCTION EQUIPMENT

REEVE ELECTRONICS, INC.
619 W. Lake Street
Chicago 6, Illinois

★ ★ ★

QUENCHING OILS

E. F. HOUGHTON & CO.
303 W. Lehigh Avenue
Philadelphia 33, Pennsylvania

PARK CHEMICAL COMPANY
8076 Military Avenue
Detroit 4, Michigan

SUN OIL COMPANY
Industrial Products Department
Philadelphia 3, Pa.

★ ★ ★

REFRACTORIES

DENVER FIRE CLAY COMPANY
2301 Blake Street
Denver, Colorado

★ ★ ★

SALTS

AMERICAN CYANAMID COMPANY
30 Rockefeller Plaza
New York 20, New York

E. F. HOUGHTON & CO.
303 W. Lehigh Avenue
Philadelphia 33, Pennsylvania

MITCHELL-BRADFORD CHEMICAL CO.
2445 Main Street
Stratford, Connecticut

PARK CHEMICAL COMPANY
8076 Military Avenue
Detroit 4, Michigan

★ ★ ★

STRAIGHTENING EQUIPMENT

GENERAL MANUFACTURING COMPANY
6437 Farnsworth
Detroit 11, Michigan

★ ★ ★

TEMPERATURE CONTROLS

METAL & THERMIT CORP.
100 East 42nd Street
New York 17, New York

★ ★ ★

TOOL STEELS

BETHLEHEM STEEL COMPANY
Bethlehem, Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA
Pittsburgh, Pa.

MANUFACTURERS' LITERATURE

The literature listed below contains information of interest to heat treating organizations. For your Copy write direct to the manufacturer and be sure you mention seeing it reviewed in "METAL TREATING".

FURNACES

The Heat Treating Supply Co., 1833 West Olympic Blvd., Los Angeles 6, Calif., has announced the availability of a catalog illustrating and describing their line of "HeaTreaT" furnaces. The catalog covers the applications for each of the company's furnaces and points out what are believed to be the salient performance features of each.

NITRONEAL GENERATOR

Baker & Co., Inc., 113 Astor Street, Newark 5, N.J., has recently published a folder describing their Nitroneal Generator for producing pure nitrogen with a controllable hydrogen content. The folder lists the applications for Nitroneal Gas and outlines what are claimed to be the important advantages of using this gas.

Specifications for each of the available units are included as well as a complete flow diagram of the generator.

HEAT AND CORROSION RESISTANT ALLOY CASTINGS

The International Nickel Co., New York 5, N.Y., has announced the availability of Bulletin A-141, a 49-page illustrated brochure on commercially available cast high alloys. The booklet includes typical compositions regularly produced with their applications, limitations and the types of service for which they are suitable. Over 175 photographs illustrate applications of typical alloys by industries. Charts compare creep strength of various alloys, resistance to corrosion in certain media, and to oxidation at elevated temperatures. It also includes tables of composition for the principle Alloy Casting Institute designations as well as certain proprietary alloys.

INDUCTION HEATING

The Weltronic Induction Heating Corp., 10230 Capital Ave., Detroit 37, Mich., has available a complete catalog describing the company's line of induction equipment for heat treating, brazing, soldering, annealing, forming, forging, and melting. The catalog contains specifications for each of the units and provides illustrations of typical applications for a wide variety of equipment. Also included are sections describing work tables, accessories and the engineering services available from the company.

THERMOCOUPLES

Charles Engelhard, Inc., 850 Passaic Ave., East Newark, N.J., has announced the publication of a brochure providing applications and specifications for thermoelements, porcelain insulators, thermocouple protection tubes and lead wires. The brochure contains information on the proper use of thermocouple system components.

CAST ALLOY DESIGNATIONS

The first revision since 1951 of the standard designation list covering the most popular grades of nickel-chromium alloys used for heat and corrosion resistant castings has just been published by the Alloy Casting Institute, Mineola, N.Y. Incorporating designation changes and several additional alloys, the revised chart of chemical composition ranges is available from ACI headquarters.

TEMPERATURE CONTROL

The Burling Instrument Company of 16 River Road, Chatham, New Jersey, has issued Bulletin 103, the third in a new series describing their line of temperature controls.

This bulletin covers the models used for controlling temperatures or as high or low temperature safety alarms and cut-outs up to 1000° F.

The two models have weathertight and explosion proof housings, respectively. Included are complete descriptions of operation, dimensions, methods of mounting, and operating specifications.

INDUSTRIAL WASTE TREATMENT

Advantages inherent in the treatment of industrial waste waters and process liquors are described in Bulletin WC-116, Industrial Waste Treatment, just published by the Graver Water Conditioning Co., 216 W. 14th St., New York, N.Y. Schematic drawings, pictures, and a problem-solution-result type of explanation demonstrate how Graver equipment solves such problems as process and cooling water shortages, contamination of streams with plant effluents, and the loss of valuable heat and materials in discarded waters and process liquors.

ROLLED HEAT-RESISTANT ALLOYS

An 8-page bulletin entitled "Low-Cost Alloys Offer Good Heat Resistance" is available free from Rolled Alloys, Inc., 4815 Bellevue Ave., Detroit 7, Michigan. The pamphlet contains valuable data on the selection, uses and properties of alloys in rolled mill forms for high temperature

service. Detailed physical and mechanical properties of five alloys are included.

COLLOIDAL DISPERSIONS

A new 4-page booklet, containing a list of 40 dispersions of colloidal graphite, molybdenum disulfide, vermiculite, and zinc oxide, has been issued by the Acheson Colloids Co., Port Huron, Mich. Typical applications, densities, carriers, and other important data are given. Recent additions to the list are dispersions which offer the advantages of the valuable new epoxy resins as bases for 'dag' colloidal graphite and molybdenum disulfide dry-film coatings.

MECHANICAL CLEANING

Pangborn Corporation, Hagerstown, Md., manufacturer of blast cleaning and dust control equipment, has issued Bulletin No. 1210, a condensed catalog of the entire line of equipment and accessories offered by the firm.

This well-illustrated 24 page bulletin has been provided with a special index which simplifies its use. All equipment and accessories are listed by equipment, by type, and by purpose. For example, one designation under Purpose is "For Fragile Castings" and the specific pieces of equipment are listed which are suitable for this particular application.

The bulletin begins by discussing Rotoblast, Airblast and Hydraulic methods of abrasive application and then pictures and describes the various types of equipment which make use of these three basic principles. All standard units are described as well as a limited number of the special machines which Pangborn has developed for particular problems.

PRODUCTIVE MAINTENANCE

A new publication, "Five steps to Productive Maintenance," has been announced as available from the General Electric Company, Schenectady 5, N. Y.

The 18-page bulletin, designated GEA-6087, provides detailed information on organizing to meet the demands that automation will make on electrical maintenance programs. Steps discussed include, (1) Gathering equipment data, (2) Determining extent of routine maintenance, (3) Establishing a routine operating control system, (4) Evaluation for critical maintenance, and (5) Establishing a critical maintenance program.

THERMOSTAT METAL

A 6-page bulletin released by American Silver Co., Inc., 36-07 Prince St., Flushing, N. Y., describes ASC-1 thermostat metal strip as well as fabricated bimetal elements for use in the heating, instrument and control fields. Tables, charts and formulas are included to assist the user in the design of thermostat metal elements.

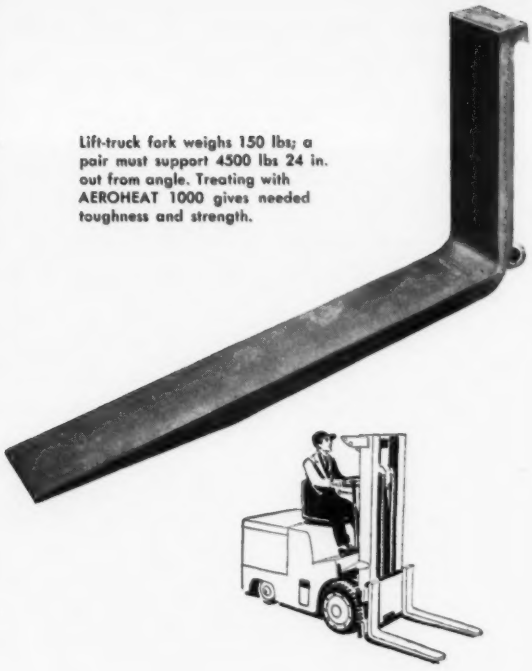
Incorporated within this bulletin is a separate thermostat metal specification sheet to be used as a reference for establishing purchasing, inspection and quality control procedures. Included here are dimensional and chemical analysis ranges and tolerances. Mechanical, thermal and electrical properties with corresponding tolerances are also listed.

HEAT TREATING NON-FERROUS METALS AND ALLOYS

A new bulletin on furnaces for heat treating non-ferrous metals and alloys is now available from Surface Combustion Corporation, Toledo 1, Ohio. Furnaces for copper and copper alloys, aluminum and magnesium alloys plus others such as titanium, high-nickel and chromium alloys are included. Forming, annealing, solution heat treating and aging are examples of some of the process equipment illustrated and described. The company's developments in equipment for controlled atmosphere processing and the use of high speed or high thermal heating for forming are also described in some detail.

Index To Advertisers

Advertiser	Page
Advance Thermal Equipment Co.	38
Ajax Electric Company, Inc.	Inside Front Cover
Allied Chemical & Dye Corp., Nitrogen Division	20
American Brake Shoe Company	27
American Cyanamid Company	Inside Back Cover
Baker & Company, Inc.	18
Bethlehem Steel Company	25
Crucible Steel Company	33
Devine Mfg. Co., J. P.	39
General Manufacturing Co.	40
Hevi Duty Electric Company	15
International Nickel Co.	21
Metal & Thermit Corporation	16
Metal Treating Institute	22-23
Misco Fabricators, Inc.	17
Park Chemical Co.	29
Pressed Steel Company, The	Outside Back Cover
Reeve Electronics Inc.	26
Rolled Alloys, Inc.	28
Rolock Inc.	37
Sun Oil Company	31



Lift-truck fork weighs 150 lbs; a pair must support 4500 lbs 24 in. out from angle. Treating with AEROHEAT 1000 gives needed toughness and strength.

Inertia wheel pins for Argus C-4 Camera. 1½ lbs, a small handful, contains 21,500 parts. Tolerance, hardness, cleanness are critical; fully met with AEROHEAT 1000.

Big parts | little parts...

Industrial Steel Treating Co. meets all its specs with AEROHEAT® 1000 Heat Treating Compound

Industrial Steel Treating Company, Jackson, Michigan, makes a specialty of giving the right heat treatment to a great variety of specialized parts—small and large.

For Argus, Inc., Ann Arbor, Michigan, they treat tiny inertia wheel pins for the precision-built Argus C-4 Camera to exacting specifications of tolerance, hardness and cleanness in AEROHEAT 1000. Made from 1095 Carbon Drill Rod, these parts are so tiny that 21,500 of them weigh only 1½ lbs and hardly fill the palm of your hand.

For the Colson-Service Co., subsidiary of Colson Corporation of Albion, Mich., they also use AEROHEAT 1000 to heat treat the 150-lb, 1045-steel forks used on Mo-Tow-Lift Fork Lift Trucks. Two forks, 24 in. out from the angle, must be tough and strong enough to support 4500 pounds.

Try AEROHEAT 1000 in your operations for better results, higher production, fewer rejects and lower costs. Mail the coupon for full information today.

Cyanamid's heat treating compounds include:

AEROCARB® Carburizing Compounds

AEROCASE® Case Hardening Compounds

AEROHEAT® Heat Treating Compounds

Other products for metal processing include:

AEROBRITE* Metal Processing Aid

Calcium Cyanamide 6-16
Metallic Stearates
Surface Active Agents
Acids and other Heavy Chemicals

*Trade-mark

MT-7

AMERICAN Cyanamid COMPANY

METAL CHEMICALS DEPARTMENT

30 Rockefeller Plaza, New York 20, N. Y.

☐ Send technical data on AEROHEAT 1000
☐ Have technical representative call

Name_____ Position_____

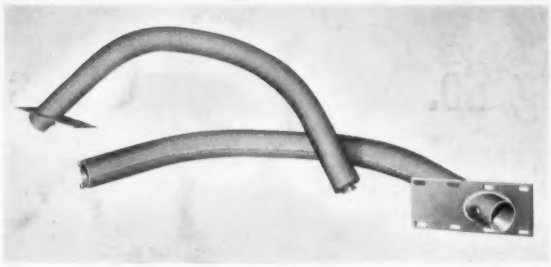
Company_____

Address_____

City_____ State_____

In Canada: North American Cyanamid Limited, Toronto and Montreal

The THIN DENSE WALLS of 'PSC' RADIANT TUBES step up furnace efficiency



Parabolic Tubes Now Made by PSC to Your Order

PSC now furnishes all types of radiant tubes, including parabolics. The tubes are precision-assembled in the most complicated designs, in any desired wall thickness, and for any temperature requirements.

In addition to such furnace parts as internal and external tubing, retorts and covers, PSC manufactures annealing and carburizing boxes, baskets, trays, fixtures, etc., for every heat-treating purpose, and in any size and design.

These tubes will help you get more production from your furnaces because: (1) Their light-wall construction saves both furnace time and fuel. (2) Their uniform wall thickness and smooth interiors promote uniform flow of gas. (3) Their dense walls all but eliminate the problems of porosity, carbon build-up and consequent burning-out. And, being 33 to 50% lighter than cast tubes, PSC fabricated alloy tubes cut initial cost and are easier to handle. A feature of PSC radiant tubes are their return bends, which are fabricated to give uniform wall thickness throughout.

Tubes in any design or dimension. Write us as to your needs.

Send for **HEAT TREATING Equipm't Cat'g 54**

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆